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Fig. 1.—Night View of General Lighting Over Sewing-Machine Tables in Hamilton, Ont., Knitting Mill—A Bright, Clean and Cheerful Work Room.

Modern Lighting and Power Installation for Canadian Knitting Mill

Electrical Equipment Complete and Designed to Minimize Fire and Accident Hazards—Interesting Details of the Lighting and Power Facilities—Safeguarding and Welfare of Employes

KNITTING mills, like other textile mills, should have the highest type of building construction and equipment in order to minimize the fire and life hazards. The raw materials used and the products made are quite inflammable; the employes are mostly women and girls. Fires breaking out in old mills have frequently caused not only heavy property loss but, worse still, have been accompanied by harrowing loss of life. In modern mills, therefore, every effort is made to overcome these dangers. An example of the best type of construction in a modern knitting mill is described in this article. It may be said, in fact, that this mill is a model one not only from the electrical installation and general building construction standpoints, but also in the efforts made to provide for the comfort and welfare of the employes.

The plant in question is located at Hamilton, Ontario, and is used for the manufacture of underwear, hosiery and sweater coats. An entire city block is owned by the company, the present building being the first unit of a very large plant which it is contemplated to erect in sections. This first unit is now fully occupied and it is expected to erect extensions in the immediate future. The building is four stories and basement in height and has ground dimensions 76 by 304 ft. It is of reinforced concrete and fireproof construction throughout. A sprinkler system is in-

stalled in every work and storage room. A very rigid inspection system has been adopted for preventing fire hazards and for keeping the factory clean and sanitary.

Every facility has been provided for the comfort and convenience of the employes. Rest rooms and

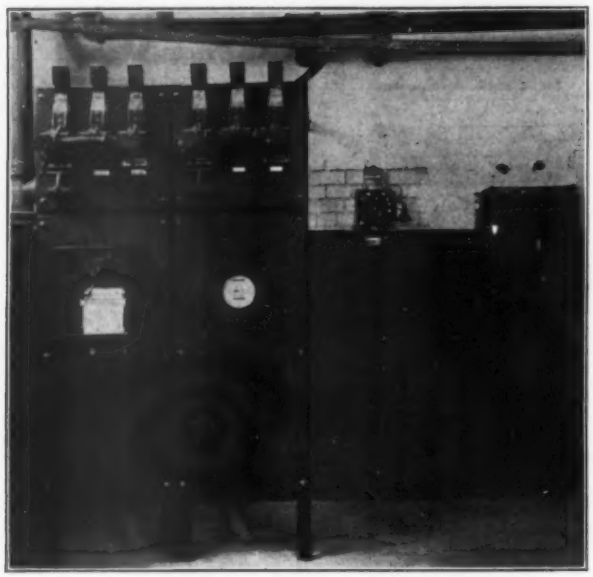


Fig. 2.—Service Metering and Control Board and Pump Controllers.

lunch rooms, including a fully equipped cafeteria, are provided where meals are furnished at cost. The building has large windows and the rooms are high with unobstructed ceilings, thus giving an abundance of light. The company has established the practice of having the interior of the mill redecorated and repainted once a year, so that the work rooms and entire premises are kept bright and cheerful. On account of these various measures, the owners of the mill have had no difficulty whatever in obtaining and keeping all the help needed.

Service and Service Equipment.

Central-station service is supplied as three-phase, 25-cycle current at 2200 volts, the service being brought underground to an underground transformer vault located just outside the factory building. In this vault are placed six step-down transformers, three for power and three for lighting, each bank being connected in closed delta. All energy is measured on the primary side of the service through instrument transformers connected to the meters on the lower panels in Fig. 2. The right-hand meter is a polyphase integrating watt-hour meter, while the left-hand meter is a polyphase graphic recording wattmeter used to show a complete record of the entire power demand at all times. The peak load shown by this meter is used by the power company for determining the demand charges on this installation. These meters were supplied by the Canadian Westinghouse Co.

The service conduits entering underground from the transformer vault lead directly behind the panels shown in Fig. 2 and pass to the I. T. E. carbon-break circuit-breakers shown in the upper panels, which are used both as service switches and cutouts for the protection of the incoming services. From these breakers the conduits lead to the main distributing switchboard shown at the left in Fig. 3.

The house service water pumps and the pump on the heating-system return are electrically driven and controlled by means of Cutler-Hammer automatic controllers shown mounted on the wall at the right in Fig. 2, all this equipment being in the basement.

Power and Lighting Distribution Boards.

In Fig. 3 is shown the switchboard for distributing the power and lighting throughout the entire factory building. All the conduits leading to the different floors are terminated in a large steel junction box shown in Fig. 3 directly above the panels. This makes a very neat method of finishing off the conduits. It eliminates the use of large conduit fittings. The cables can be rearranged in this cabinet so that they come directly over the terminals of the switches without crossing, no matter where the conduit enters the cabinet. Bushings are used on the under side of the cabinet for insulating the cables where they pass through the wall of the cabinet. Bringing the cables out in this manner makes a very compact arrangement at the rear of the panels. A voltmeter is provided on the power and lighting panels to indicate the voltage of any phase. Ground-detector lamps with plug receptacles are also used for ascertaining the condition of the system at all times with respect to accidental grounds.

At the right of Fig. 3 is shown the panel for controlling night lights, exit lights, stair lights and all lighting used on the exterior of the building. This places the control of this lighting under the plant electrician, who is responsible for the use of the same. A wire mesh enclosure (not shown in the illustration) is used to prevent any person coming in contact with the live parts of apparatus exposed on the switchboard panels. This also prevents unauthorized persons tampering with this apparatus. The switchboard is located in the basement adjacent to the boiler room. The remainder of the basement is used for storage

Fig. 3.—Power and Lighting Distribution Board and Panel for Special Lighting.

purposes. The three elevators are Otis Fensom type, using alternating-current slip-ring type motors with magnet control panels in pent house. Each elevator is supplied by a separate feeder direct from the switchboard controlled by a separate switch and fuse.

Fig. 1 shows a typical illustration of the lighting used throughout in this mill. Benjamin deep-bowl steel enameled reflectors are used with 60-watt Mazda

lamps, mounted 7 ft. from the floor. This form of lighting has been found highly satisfactory for sewing-machine work, as shown in Fig. 1. There is a very uniform light distribution and a marked absence of shadows. The units are placed in such locations that it is impossible for the operators to sit in any position where they do not receive sufficient illumination on their work and there is no glare in their eyes. This form of modified general lighting is found much superior to individual lighting for each operator. The fixtures are flexible so they will not be injured by workmen carrying ladders about. On some of the other floors ceiling-mounted lamps with deep-bowl reflectors are used.

A few of the night lights used by the watchmen are shown in Fig. 1 mounted on the ceiling. There are two of these units on each floor. The results are very satisfactory, using 60-watt lamps and glass reflectors. These night lights eliminate the necessity of watchmen carrying oil lanterns or other portable lamps throughout the mill and give abundant general illumination over the entire floor for the watch service.

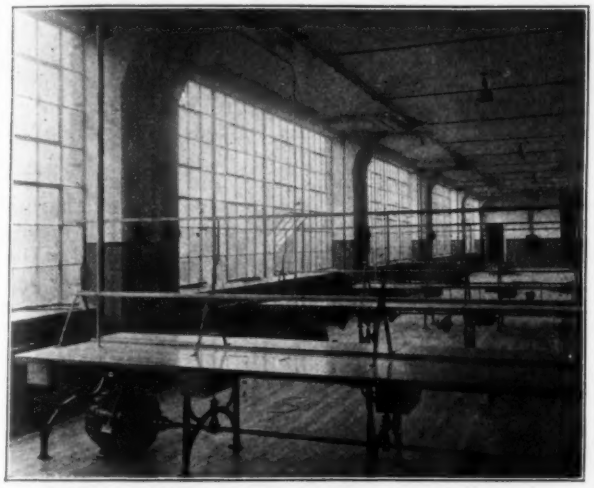


Fig. 4.—Typical Motor Drive for Sewing-Machine Tables—View Taken Before Completion.

At the entrance to each stairway is a 25-watt red lamp as an exit marker—an important provision in case of possible fire.

Machine-Drive Motors and Control.

In Fig. 4 is shown a sample of the motor installation for sewing-machine tables. These motors are 2-hp., three-phase, 220-volt, 25-cycle, 300-r.p.m induction motors each direct-connected to a line shaft under the table. This eliminates overhead belting and has proven very satisfactory. Each of these tables is equipped with 10 sewing machines. The wiring to the motor is installed in exposed conduit. The control switches and fuses are enclosed in steel boxes, mounted on the columns as shown in Fig. 4. Detroit Square D type switches are used throughout in this mill for controlling all motors from 1 to 5 hp., inclusive. A power feeder is shown on the ceiling in Fig. 4 with junction boxes located near each column for supplying the different motors. One of the lighting panels is also shown on the rear wall in Fig. 4. These panels are Krantz type surface panels with slate gutter and knife switches.

In Fig. 5, three control switches for the sewing-machine table motors are shown mounted on the column with exposed conduit and condulets. This makes a very satisfactory installation from both the fire and life-hazard point of view. No live parts are exposed. The switches are operated from the outside of the box by suitable handles. In Fig. 6, three ironclad Square

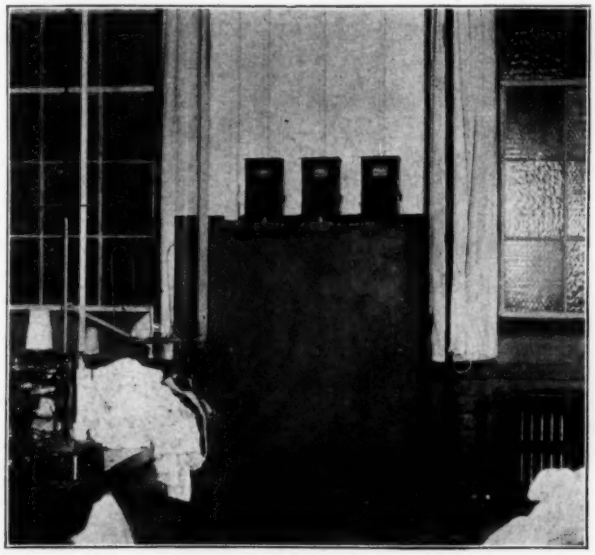


Fig. 5.—Enclosed Switches for Control of Three Sewing-Machine Table Motors.

D switches are shown mounted on the column for controlling three 5-hp. motors. These switches are double-throw type operated by handles on the exterior of the box. By the use of this form of switch the motor running fuses can be installed much smaller to give better protection, as the fuses are not in the circuit during the starting period. This apparatus has given very satisfactory service.

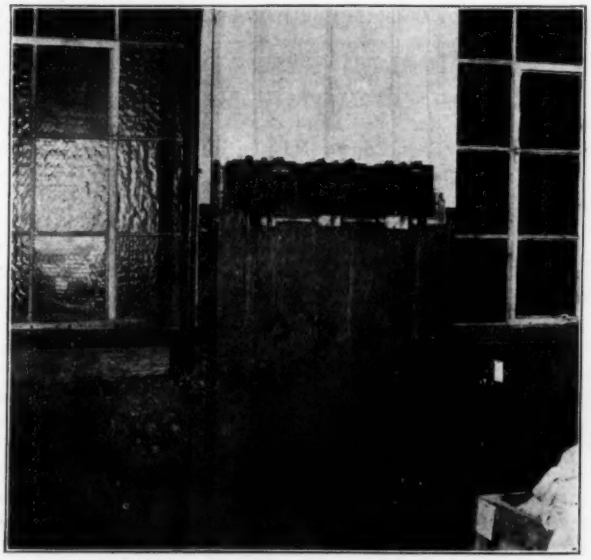


Fig. 6.—Enclosed Double-Throw Switches for Three 5-Hp. Induction Motors.

In Fig. 7 is shown the method of hanging shafting and motors on the ceiling. Channel iron is used with bolts and special castings in conjunction with suitable inserts in the concrete ceiling. The shafting can be shifted very readily by this method. The motors are 5-hp., three-phase, 220-volt, Canadian Westinghouse

type C.C.L., 300-r.p.m., direct-connected to the line shaft with flexible couplings. This eliminates a great deal of heavy belting for main drives. The ironclad control switches are shown mounted on the columns for controlling these motors. The power main is

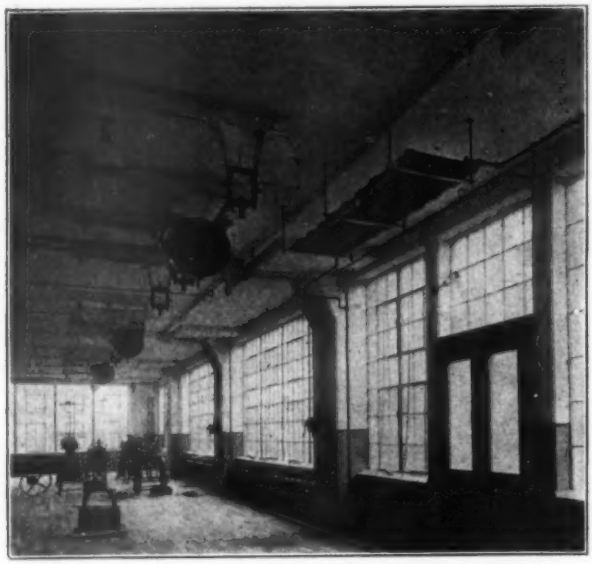


Fig. 7.—Method of Mounting Motors on Ceiling—Shafting Not Yet Installed.

mounted on the ceiling in exposed conduit with suitable junction boxes opposite each column. This section of the factory is used for knitting machines required in manufacturing heavy sweater coats and other woolen goods of this description.

All of the electrical installation was supervised by the Inspection Department of the Hydro-Electric Power Commission of Ontario and is looked upon as a model factory installation in every particular.

MANY CRIPPLED SOLDIERS CHOOSE STUDY OF MOTOR MECHANICS.

Popularity of This Course Results in the Establishing of Numerous Schools in Many Countries.

By Douglas C. McMurtrie.

Motor mechanics has proven a most popular subject of instruction for crippled soldiers who are being retrained to become self-supporting, self-respecting workers. In fact, the trade is almost too popular, say directors of Canadian schools in which hundreds of disabled soldiers are today being trained in new occupations. Practically every Canadian soldier who is asked to choose from among the various trades in which classes are operated selects automobile mechanics—but most of the men are dissuaded from their intention and are turned into other channels of industry. Otherwise, every crippled soldier in the Dominion would be looking for a job as automobile mechanic after he had completed his course of training, and the supply would far exceed the demand.

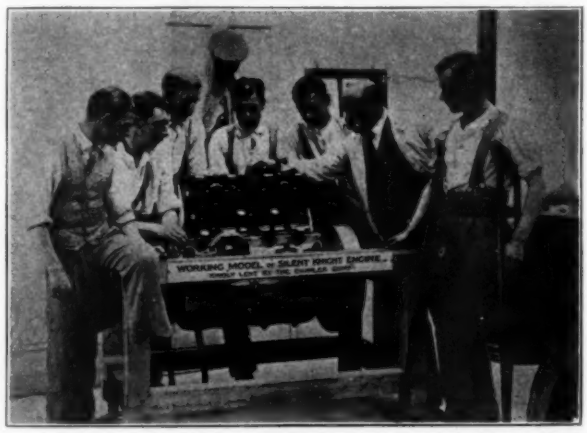
Canada, England, Germany and India are among the belligerents that offer training courses in motor mechanics to the disabled men of their own forces, and America, in line with the program of re-education that she has adopted, is teaching her wounded and disabled soldiers automobile repairing. At Fort McHenry, where the United States operates a large reconstruction hospital, one of the trades taught to convalescent soldiers is automobile mechanics. A one-armed or a one-legged automobile mechanic, therefore, will not be new, once the general public has been committed to the principles of re-education.

In British Columbia gasoline-engine classes were organized soon after the wounded began returning from overseas. Vancouver, Victoria, Esquimault and Westhaven provide instruction in motor mechanics. As there is also a big field for workmen in this trade in Saskatchewan and through all the West, thorough courses are given for war cripples by the University of Saskatchewan. Another course is at the Provincial Institute of Technology and Art at Calgary. Disabled men so trained compete successfully with the average sound mechanic.

While the wounds of English soldiers and sailors are healing at Queen Mary's Convalescent Hospital at Brighton and Roehampton, they are afforded the opportunity of learning motor mechanics. The workshop at Roehampton, which is shown in the illustration, is fitted up as a model garage in charge of disabled men who, besides being skilled instructors, understand the special problems of the war cripple.

Germany, too, has excellent training courses for war cripples who take up motor mechanics. At Düsseldorf on the Rhine, by the co-operation of the provincial and city administration and local welfare societies, war cripples are being trained in many skilled trades.

Even in far-off India, the trade of automobile mechanics takes hold of the imaginations of the natives. It must be a curious sight, indeed, to see India's disabled sons repairing an automobile or studying the intricacies of mechanics in the shops that are operated at Queen Mary's Technical School at Bombay. These curly-bearded, olive-skinned warriors will not be left



Disabled Soldiers Learn Automobile Mechanics at Roehampton, England.

on the highroads to beg after they have served their country, but will be trained for useful trades in which their physical handicaps do not prevent them from competing with able-bodied men.

Electric welding has been introduced with satisfactory results in the shipyards where concrete ships are built. It is used for connecting members of the reinforcement as an alternative to the use of wire ties. The welds are quickly made and hold the bars firmly in their final positions so that the blocks, wedges and distance pieces otherwise necessary can be entirely eliminated.

Aeronautics in the United States

Major General George O. Squier Gives First Authentic Information of the Great Work Done by the Aeronautics Branch of the War Department—Important Scientific Developments

At a meeting of the American Institute of Electrical Engineers in New York on Jan. 10, Maj. Gen. George O. Squier presented an instructive paper entitled "Aeronautics in the United States." The paper consisted of a general description of the development of aeronautics in America after America entered the war, and included a large amount of technical information which has not been published heretofore. The paper sets at rest effectively any opinion among engineers to the effect that the Aeronautics branch of the War Department was not conducted efficiently and in a manner intended to produce results. Among the facts presented by the paper, the one that the development of aeronautics in general was not only a feat of engineering, but was also a triumph of the genius of American engineers, was most thoroughly appreciated.

Not the least important of the features of the paper was the description of the strictly scientific work done by the personnel of the signal service, composed, necessarily, of scientists drawn from colleges and

Major General George O. Squier.

industrial organizations. These scientists included mainly chemists, physicists and electrical engineers, men who were specially qualified to consider the most recent phases of chemical, meteorological, and electrical phenomena and to develop and perfect new apparatus required by the signal service. The important things accomplished by these scientists include the successful production of helium in commercial quantities, the charting of the upper strata of the atmosphere, and the development of radio apparatus.

The Production of Helium.

The production of helium in commercial quantities is one of the developments which is most startling. This accomplishment, though only one of the accomplishments of the department of Aeronautics, justifies the course pursued by that department in basing its work on the investigations of a purely scientific nature. Concerning the production of helium, Gen. Squier said:

One of the greatest scientific achievements of the present war from a technical standpoint is the production of helium in balloon quantities. This gas is non-inflammable and has about 92% of the buoyant effect of hydrogen. Its name is due to its having been discovered in the sun's atmosphere through a characteristic line in the solar spectrum, before its presence on the earth, or any of its properties were known. It first was obtained in minute quantities by Ramsay in England some 20 years ago by heating certain radioactive minerals, in which it occurs because it is a disintegration product of radium. Its pre-war scarcity may be appreciated from the fact that, up to 2 years ago, not more than 100 cu. ft. ever had been obtained, and the usual selling price was about $1700 a cu. ft.

Notwithstanding so discouraging an outlook someone in the British Admiralty had imagination enough to propose the large scale separation of helium from certain natural gases in Canada, that contain about one-third of 1% of it, and experiments were undertaken at the University of Toronto. Soon after the entry of the United States into the war, the Bureau of Mines, learning of the problem from a British confidential memorandum, persuaded the Signal Corps and the Bureau of Steam Engineering of the Navy to approve and finance jointly an experimental program on a large scale. Thanks partly to the unusually rich sources of supply in this country, and partly to the skill of the two commercial companies whose services were enlisted, and to the enthusiasm of the Bureau of Mines Staff and of Mr. Carter, of the Navy, who for a time represented the Army as well in the project, such success was achieved that at the cessation of hostilities, there was compressed and on the dock ready for floating 147,000 cu. ft. of nearly pure helium, and plants were under construction to give at least 50,000 cu. ft. a day at an estimated cost of not more than 10 ct. a cu. ft.

The production of a balloon gas that assures safety from fire opens up a new era for the dirigible balloon. In November, 1917, a Zeppelin made the trip from Bulgaria to German East Africa with 25 tons of medicines and munitions, only to find that the German forces already had been dispersed, and returned safely to its base without landing. With a non-inflammable gas, not only comfortable and expeditious, but also safe transcontinental and transatlantic travel in dirigibles will, it is believed, soon be commonplace."

Meteorological Service.

The meteorological service, also, of the Signal Corps made some important discoveries. These have such an important bearing on the possibilities of the use of airships for commercial purposes that they have changed the ideas of aeronautical engineers. With respect to such use concerning the work of the meteorological service Gen. Squier said:

In August, 1917, the Chief Signal Officer directed Lieut. Colonel R. A. Millikan to organize an Army Meteorological and Aerological Service, the purpose of which was three-fold:

(a) To provide the American expeditionary forces with all the meteorological and aerological information needed.

(b) To supply the aviation fields, the coast artillery stations, the ordnance proving grounds, and the gas war service within the United States with such meteorological and aerological data as might be useful to them.

(c) To undertake for the first time in the history of the world the problem of mapping the upper air currents over the United States, the Atlantic, and Western Europe in aid of aviation, and particularly with reference to transatlantic flight . . . . . .

In carrying out the third element of the program, 26 meteorological stations were established, placed at carefully selected points over the whole of the United States, which stations have been manned by trained observers who telegraph to Washington each day observations and wind velocities at all altitudes up to 35,000 ft. In one instance

these observations have been carried to 65,000 feet. On the basis of these observations, a daily forecast of upper-air winds is now being issued. The use which such forecasts may serve, both in connection with the aviation mail service and ultimately with the trans-atlantic service, may be seen from the fact that above the level of 10,000 ft., 95% of the winds in both the United States and Europe are from West to East and often attain velocities in excess of 100 miles an hour. On Nov. 6, 1918, at Chattanooga, Tenn., a velocity of 154 miles an hour at an altitude of 28,000 ft. was observed. It is because of this westerly direction of these upper air currents that all of the long flights thus far made have been from west to east. The importance of a forecast of such currents for the purpose of long flights will be appreciated as soon as the foregoing facts are understood. An airplane capable of a velocity of 154 miles an hour in still air either would remain stationary or travel at 308 miles an hour depending on whether it was headed into or with a wind of the velocity of that observed at Chattanooga.

All of the aerological work so far mentioned has been done with the aid of theodolites especially designed by Major W. R. Blair for this service. Sixty of these have been built for the work in this country and 20 shipped abroad.

The problem of exploring the upper-air currents over the Atlantic was at first thought insoluble on account of the absence of fixed bases, but the Meterological Service has developed propaganda balloons which already have flown at an average altitude of 18,000 ft. from Omaha to New Jersey, a distance of more than 1000 miles. The success of the project now has made possible the mapping of the upper-air highways across the Atlantic; for arrangements are being made to send up from both coastal stations and from trans-atlantic steamers, these long-range balloons designed for from 2000 to 3000-mile flights, and adjusted to maintain a constant altitude and to drop in Western Europe their records of average winds in these heretofore unchartable regions. The importance of this work for the future of aviation needs no emphasis.

Radio Development Work.

Developments in radio equipment, both telegraphic and telephonic, were particularly extensive. When America entered the war, the practicability of the use of radio equipment in connection with aircraft was scarcely conceived; when the armistice was signed, a fleet of airships could be directed by a commanding officer either on the ground or in an airship in the fleet. The development of this radio equipment was revealed by Gen. Squier, who said:

In the question of the engineering achievements of the Signal Corps during the war, the development of radio apparatus forms a large part. Inasmuch as the vacuuum tube occupies so prominent a role in almost every kind of radio apparatus, an outline of its development logically precedes discussion of the radio sets.

Development of Vacuum Tubes.

The application to radio inter-communication of the vacuum tube—perhaps more properly called the thermionic tube or bulb—is one of the most interesting developments in the whole field of applied science. For not only has it made possible what has been justly heralded as one of the most spectacular achievements of the whole war—the airplane radiophone—but the confidence growing out of the extensive experience with the vacuum tube in warfare, coupled with its extreme adaptability, have resulted in a rapidly increasing amount of radio development involving its use.

The vacuum tube was known in various forms before the war. Following extensive experiments with the so-called "Edison effect," Fleming, some years ago, produced the well-known Fleming valve—a current rectifying device, capable therefore of being used as a detector of radio signals. This device contains two elements: an incandescent filament emitting electrons, and a plate upon which an alternating voltage is impressed, both placed within an evacuated bulb. Later Dr. Lee DeForest introduced an important modification by placing a wire mesh or "grid" between the filament and the plate. A small voltage variation on this grid produces the same current change through the tube as would a much larger voltage variation on the plate, thus adding amplifying properties to the detector characteristics of the Fleming valve. DeForest called his device the "audion." Later, with superior facilities for evacuation available and with a more intimate knowledge of the laws of thermionic emission from hot bodies, improvements and modifications were made in the audion or vacuum tube by both the General Electric Co. and the Western Electric Co., the latter designating their product as "vacuum tube," and the former the "pliotron."

In addition to acting as detectors and amplifiers, as mentioned above, vacuum tubes can function in two other important ways:

1. As oscillators. In properly designed circuits containing inductance and capacity they will act as radio frequency generators, for use in transmitting or receiving radio signals.

2. As modulators. By suitable connection to an oscillator circuit or antenna, they can be made to vary the power radiated so that the envelopes of the waves transmitted shall have any desired wave form, as for example, the speech waves from an ordinary telephone transmitter.

The most striking use made of vacuum tubes prior to the time we entered the war was the transmission of speech by radio from Washington to Paris and Honolulu, during the experiments carried out by the American Telephone & Telegraph Co. and the Navy Department. Vacuum tubes were used as the radio frequency generator for transmitting, and for detector and amplifier in receiving.

When the United States entered the war, vacuum tubes already were in use by the Allied forces for various signaling purposes. The French particularly had been quick to recognize the military value of vacuum tubes and had, previous to June, 1917, developed very creditable tubes and apparatus. In America, tubes were in limited use as "repeaters" on telephone lines, and as detectors and amplifiers in laboratories and radio stations. The total production, however, in this country did not exceed 300 or 400 a week.

Early in our participation in the war, it became evident that vacuum tubes would be required in very large quantities in order to meet the growing demands for radio communication and signaling. It was equally evident that service conditions, not hitherto anticipated, would require great mechanical strength, freedom from disturbance under extreme vibration, and uniformity of product sufficient to make possible absolute interchangeability of the tubes in sets, without the necessity of readjusting when changing tubes. To these conditions must be added that of minimum size consistent with dependable operation.

To make such a device, with its complicated, yet accurately constructed metallic system, within a practically perfect vacuum, is no small problem even when made in the laboratory, on the individual unit basis by a skilled operator who appreciates the delicacy of the job. To turn out tubes by the thousands by factory methods involves almost infinitely greater difficulties. How well certain companies, in collaboration with the Signal Corps, have succeeded in solving these difficulties is indicated by the fact that recently the total rate of production in the United States of high-quality standardized tubes was considerably in excess of one million a year. This rate of production could be made many times greater on short notice.

As an example of the difficulties which this quantity production has involved may be mentioned that of evacuation. The degree of vacuum required is such that unusual methods of exhaust are necessary. The heating of the tubes in electric ovens is supplemented by heating of the elements of the tube by excessive filament and plate electrical power input. Molecular pumps are employed, necessitating an extremely large number of pumps to handle quantity production. Special treatment of metal parts prior to assembly is employed to reduce the gas given off by them during the exhaust process.

Another problem is that of making the complicated metallic structure of all tubes exactly alike, in order to insure identical electrical properties. As an indication of progress in this direction, it may be stated that one company is prepared to manufacture, in quantity, a certain tube in which the clearance between filament and grid is only 3/100 of an inch, the allowable variation being of course only a small percentage of this.

Tubes developed by the Signal Corps may be divided into two general classes: the tungsten filament types as developed and manufactured by the General Electric Co. and the De Forest Radio Telephone & Telegraph Co., and the coated filament or Wehnelt Cathode types as developed and manufactured by the Western Electric Co. The coated filament the advanced "firing line" of so-called pure physics, and applied engineering.

Airplane Radio Telephone and Telegraph Sets.

Prior to April, 1917, a few experiments had been made, in which speech had been transmitted from airplane to ground by radio methods; but the apparatus involved was hopelessly crude. On May 29, 1917, the Chief Signal Officer called a conference in his office at which the project of

evolving a "voice command" equipment for airplanes, which should meet all the severe reqirements of the military service, and which should be thoroughly standardized for quantity production, was definitely set in motion against time. The present airplane radiophone, therefore, is the result of a period of intensive development work begun shortly after we entered the war. The services of the Western Electric engineers were enlisted, and under the direction of the Signal Corps, rapid development resulted in successful tests as early as August, 1917. Speech was exchanged between airplanes 25 miles apart in October, and sample sets were sent at once to the Army in France for trial. Several thousand sets were ordered and have been completed and distributed to flying fields here and to the Air Service in France.

The satisfactory performance of this apparatuus has resulted in a new type of military unit known as a voice-commanded squadron. The commander of an air fleet directs the movements of the individual units in any manner desired; the effectiveness of the squadron as a military machine is thereby enormously increased.

Other uses are in communicating information from airplanes to ground stations, and in directing one or more airplanes from a ground station. Innumerable applications will be evolved as the possibilities are realized.

The essential elements of the Airplane Radiophone are the power equipment, the radio equipment, and the antenna.

a. The power equipment includes a double-voltage direct-current generator driven by an air fan, with a vacuum tube voltage regulator.

b. The radio equipment consists of the vacuum tube transmitting and receiving set, and the special telephone transmitters and receivers. Those of you who have heard the terrific roar of a Liberty engine will realize the difficulty of talking in an airplane in flight. The development of a transmitter which is affected by the human voice, and not by the enormously greater engine and wind noises, is one of the principal features of this set. Similarly, to shield the ears of the aviator from the same noises required a special combination of sound-insulating materials surrounding the telephone receivers and suitable for use within an aviator's helmet.

c. The antenna originally consisted of a flexible copper wire several hundred feet long, unreeled by the aviator and trailing almost horizontally behind the airplane. Modified antenna using much shorter wires fixed to the framework are now used.

The operation of the sets is extremely simple, all adjustments being made before leaving the ground. The only manipulation required of the aviator is that of the change-over switch to change from talking to listening.

The principal use of radio communication made during the war was in sending radio telegraph signals from observation airplanes, for controlling artillery fire. The French developed a set which consisted of several units, making the installation and operation complicated. The Signal Corps developed a self-contained set, which has been demonstrated to be far superior to any other airplane set.

It consists of three units—first, the 200-watt, 900-cycle alternator, driven by a regulating air fan, and containing in a stream line case attached to the generator, all the elements of the radio set. This radio apparatus is of the synchronous spark type, with four spark tones and nine wave lengths. The weight of the complete unit is only 23 lb., and size only 6 by 6 by 26 in. The regulating air fan maintains the speed of the generator within 4% of 4500 rpm., with air velocities between 60 and 200 miles an hour.

The remaining units in the complete set are a variometer or tuning coil, with antenna ammeter attached, and the antenna system, comprising a reel, insulated bushing, and training antenna. When it is realized that voltages of thirty thousand or more are produced by this set, the difficulties of insulation in such restricted spaces will be appreciated.

Ranges of communication of 100 miles have been accomplished with this set.

Airplane Direction Finder.

One of the principal problems of airplane navigation has been the evolution of a suitable compass, particularly for tubes so far have proven superior to the tungsten filament tubes for Signal Corps use. Both classes have been standardized as regards base, exterior dimensions, filament current and voltage, and in addition, plate voltage and output for transmitting tubes; and amplifying power and detecting power for receiving tubes. Except in certain special cases, the Signal Corps uses two types of tubes, one for transmitting, and another for receiving. The French and the British have been using one type for both transmitting and receiving, but present tendencies of the British are toward different tubes for different duties.

Vacuum tubes are now employed for electric wave detection, radio frequency and audio frequency amplification, radio telephony, particularly in the airplane radiophone, continuous wave radio telegraphy, voltage and current regulators on generators, and for other miscellaneous purposes. However, varied as are the applications at present, the uses, actual and potential, growing out of war development work have proved that the art of Vacuum Tube Engineering, and the application of its products to radio engineering, telephone and telegraph engineering, and particularly to electrical engineering in general, are still in their early infancy. That vacuum tubes in various forms and sizes will, within a few years, become widely used in every field of electrical development and application is not to be denied.

The engineering advancement accomplished in less than 2 years represents at least a decade under the normal conditions of peace, and our profession will, it is hoped, profit by this particular salvage of war which offers perhaps the most striking example extant of a minimum "time-lag" between night bombing work. Magnetic and gyroscopic compasses have limitations at present which make impossible reliable air navigation by dead reckoning.

The use of directional effects of loops or coils for receiving radio signals have resulted in the development of a radio compass for airplanes which gives positive information to the aerial navigator, and enables him either to locate his position by triangulation with respect to two beacon land stations, or to fly at any given angle with respect to a certain beacon station.

The apparatus consists of two principal parts—the antenna coils, and the tuning and amplifying apparatus. The antenna coils are mounted in the fuselage of the Handley-Page airplane, with suitable means for rotating in azimuth. The amplifier is extremely sensitive, consisting of a detector and six-stage amplifier. A novel feature of the amplifier is the use of iron-core transformers for frequencies of 100,000 cycles.

The direction of the beacon land radio station is determined by maximum strength of signals, in a highly ingenious manner developed originally by the British. The precision of the directional effect is remarkable. In fact the radio direction finder may well be called a radio eye, by which the aerial navigator sees one or more radio light-houses which are sending identifying signals to guide him on his way. These light-houses, furthermore, have certain advantages over the normal light-house in that their ranges may be much greater, and they are not invisible in the day time nor obscured by fog and mist.

The remarkable advances made during the last eighteen months have resulted in the application of radio communication to practically every phase of military aviation. Commercial and military possibilities have, however, hardly been touched as yet. It is believed that radio apparatus soon will be as essential on aircraft as it now is on ocean going steamships, and that its use will enormously increase the effectiveness of aircraft for all purposes.

General Squier's lecture was followed by one by Capt. A. Bliss Albro on aircraft production which was illustrated. The illustrations showed the devices adopted by American engineers to obtain quantity production. Among the illustrations was a hitherto censored reel which showed the performance of the latest models of aircraft when climbing and manoeuvering. The information which was released during the two lectures was sufficient not only to quiet all criticism of aircraft development, but even to evoke the applause of intelligent Americans because of that development.

1327 A. I. E. E. MEMBERS IN SERVICE.

In recognition of the service rendered by members of the American Institute of Electrical Engineers during the great world struggle, the Institute publishes in the January issue of its proceedings an honor roll containing the names of all members who have been in the uniformed forces of the United States and its allies. The revised roll of honor to Jan. 1 totals 1327 names and may be summarized as follows: U. S. Army 984; U. S. Navy 273; U. S. Marine Corps 2; British army 55; British navy 6; French army 5; Italian army 1, and Japanese navy 1.

Power and Torque in Electric Motors

Fourth of a Series of Articles Discussing the Principles of Different Types of Motors From a Common Standpoint—Fundamental Relations in Single-Phase Induction Motors

By JUSTIN LEBOVICI

Lack of clear understanding of the action of alternating-current motors is due largely to failure to consider their principles on a basis applicable to all classes of motors. In this series of articles Mr. Lebovici presents a discussion of power and torque of different kinds of motors based on the principles of the direct-current motor and of the static transformer. The fundamentals were reviewed in the first three installments and applied to the direct-current and polyphase induction motors. The present installment begins discussion of the single-phase induction type. These articles should be read in connection with the author's two series of articles on alternating-current motors and their windings published in our issues during 1916.

IN THE earlier articles of this series we have discussed the general principles of electric motors as they affect power and torque and have then applied these principles to the direct-current and polyphase induction types of motors. We will now in a similar way take up the single-phase type of induction motor.

Single-Phase Induction Motors.

Fig. 42 represents diagrammatically a single-phase induction motor. The stator S_1 magnetizes along one axis only. The magnetic reluctance is assumed to be the same in all directions. The rotor may be of the squirrel-cage, slip-ring or wound-rotor type, having leads brought out to commutator bars and the commutator bars short-circuited in groups or entirely.

(a) Starting Torque.

The flux of mutual induction ϕ_1 pulsating along the YY axis induces emf's E_{3p} and currents I_3 in the rotor lining up along a vertical axis in Fig. 42.

As previously explained, the axis of these currents coinciding in space with the axis of the flux ϕ_1 cannot produce torque with the flux ϕ_1. The single-phase induction motor with short-circuited secondary is not self-starting. In order to make the single-phase induction motor self-starting, the rotor is provided with a commutator for the purpose of producing a torque flux at right angle in space and in time phase with the currents I_3. After the motor has reached a certain speed the commutator bars can be short-circuited and the motor will continue to run in the same direction and perform work.

Another popular scheme for starting small single-phase motors is to provide temporarily, by means of an auxiliary winding on the stator, a flux at right angle in space to the axis of the currents I_3 and less than 90° displaced in time phase from I_3. These motors are known as split-phase induction motors.

(b) Normal Running Conditions.

Assuming the motor had been started in a clockwise direction of rotation, the following conditions will prevail.

Along the YY axis we have the same conditions as in a short-circuited transformer. The applied voltage V_1 will produce the magnetizing current I_{m1} and the mutual flux ϕ_1 lagging far behind V_1. We plot ϕ_1 in the time diagram, e. g., in the direction bottom-top and consider this the positive axis, since we have drawn ϕ_1 in the space diagram Fig. 42 in a positive direction.

The flux produces through its pulsation an emf. E_{3p} along the vertical rotor axis (Fig. 42). E_{3p} lags in time 90° behind ϕ_1 and is so drawn in Fig. 43. E_{3p} can be calculated from the equation

$$E_{3p} = 2\sqrt{2}\, f\, w_2 \phi_1 10^{-2} \text{ volts} \quad \ldots\ldots\ldots\ldots (70)$$

Since the rotor conductors are cutting the flux ϕ_1 in their movement, an emf. E_{2r} is generated through rotation in the rotor winding w_2. The direction of E_{2r} is indicated in Fig. 44 and it is seen that E_{2r} magnetizes along the axis XX in a negative direction. E_{2r} will be plotted in the time diagram along the line of the flux ϕ_1 and in a negative direction. The value of E_{2r} is obtained from equation

$$E_{2r} = 2\sqrt{2}\, f_r w_2 \phi_1 10^{-2} \text{ volts} \quad \ldots\ldots\ldots\ldots (71)$$

E_{2r}, acting on the short-circuited rotor winding along XX, will induce through its pulsation a flux ϕ_4 along XX (see Fig. 44); ϕ_4 will be just large enough so that through its pulsation an emf. E_{2p} will be in-

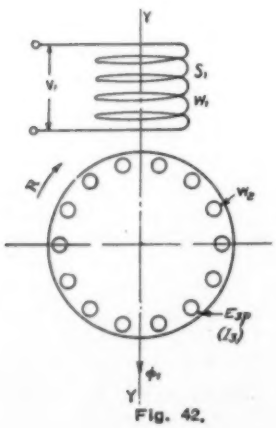


Fig. 42.

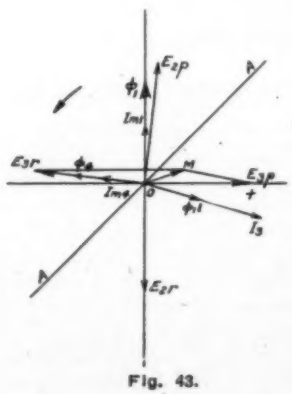


Fig. 43.

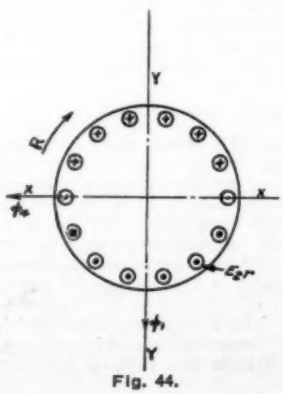


Fig. 44.

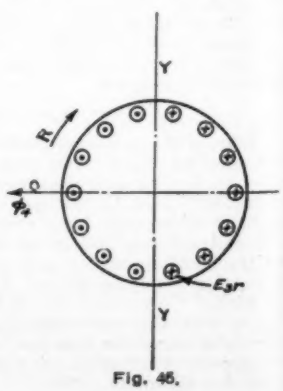


Fig. 45.

duced along XX opposing E_{2r} and so that the vector sum of E_{2r} and E_{2p} covers the impedance drop along the XX axis.

The flux ϕ_4 lags far behind E_{2r} in the time diagram Fig. 43. Since ϕ_4 magnetizes in the space diagram, Fig. 42, along a negative axis, it follows that the negative axis in the time diagram, Fig. 43, coincides with the direction of ϕ_4 and is from left to right.

The only current flowing along the rotor axis XX is the magnetizing current I_{m4} giving rise to the flux ϕ_4, hence the emf. E_{2r} will differ from E_{2p} only by the impedance drop and we can write approximately,

$$E_{2p} = E_{2r} \quad \ldots\ldots (72)$$

or $$2\sqrt{2}\, f\, w_2 \phi_4 10^{-2} = 2\sqrt{2}\, f_r w_2 \phi_1 10^{-2} \quad \ldots\ldots (73)$$

or $$f\phi_4 = f_r \phi_1 \quad \ldots\ldots (74)$$

therefore

$$\phi_4 = (f_r/f)\phi_1 \quad \ldots\ldots (75)$$

Since the rotor conductors are cutting through the flux ϕ_4, an emf. (see Fig. 45) is generated by the rotation and magnetizing along a negative axis. Plotting this E_{3r} along the same line as the flux ϕ_4 and in a negative direction in the time diagram, Fig. 43, it is seen that E_{3r} opposes the emf. E_{3p} impressed on the rotor axis by transformation and is the real counter emf. of the motor.

Since the rotor is short-circuited, the emf's E_{3p} and E_{3r}, combining to produce the load or torque current

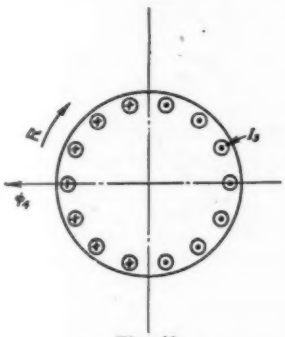


Fig. 46.

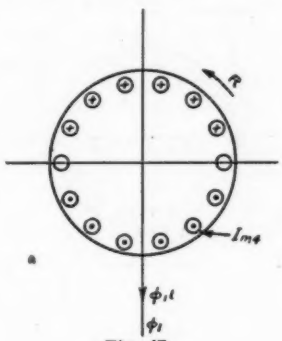


Fig. 47.

I_3, cannot differ greatly; hence we can write as an approximation for determining the value of the flux ϕ_4

$$E_{3p} = E_{3r} \quad \ldots\ldots (76)$$

$$2\sqrt{2}\, f\, w_2 \phi_1 10^{-2} = 2\sqrt{2}\, f_r w_2 \phi_4 10^{-2} \quad \ldots\ldots (77)$$

or $$f\phi_1 = f_r \phi_4$$

and, since we had previously found from (74) that

$$f\phi_4 = f_r \phi_1$$

it follows that

$$\phi_1 = \phi_4 \quad \ldots\ldots (75)$$

or the cross flux ϕ_4 is of the same order as the flux ϕ_1 and, according to Figs. 43 and 44, the fluxes ϕ_1 and ϕ_4 are in time and phase quadrature. It would then be expected that this motor will behave similarly to the polyphase induction motor previously treated. The flux ϕ_4, which is supplied through the stator winding in the polyphase motor, is generated through rotation in the rotor itself in the case of the single-phase induction motor. We are then entitled to speak of a self-excited induction motor.

(c) Torques Existing in Motor During Running. The emf's E_{3p} and E_{3r} acting in the axis of the stator winding S combine to a resultant emf. $\overline{OM}$, as shown in Fig. 43. The emf. acting in the rotor circuit along the axis YY will give rise to a current I_3 determined in size and direction by the rotor impedance.

Studying Figs. 42, 43 and 45, it is seen that the current I_3 is in space quadrature and practically in time phase with the flux ϕ_4 and hence in a very favorable condition to produce torque.

In order to determine the direction of rotation resulting from the interaction of I_3 and ϕ_4 we may proceed in the same way as before and refer the two vectors to a certain axis, e. g., AA, Fig. 43. It will be

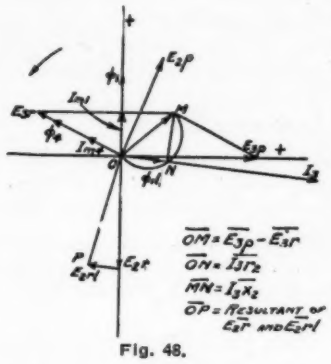

$\overline{OM} = \overline{E_{3p}} - \overline{E_{3r}}$
$\overline{ON} = \overline{I_3 r_2}$
$\overline{MN} = \overline{I_3 x_2}$
$\overline{OP}$ = Resultant of $\overline{E_{3r}}$ and $\overline{E_{2r}}$

Fig. 48.

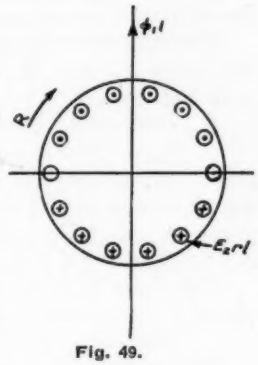


Fig. 49.

seen that ϕ_4 magnetizes along the negative AA axis, while I_3 magnetizes along a positive axis, as shown in Fig. 46. The rotor would move in a clockwise direction (in accordance with Fleming's left-hand rule) or in the same direction as it had been started. It follows that the single-phase induction motor will maintain its rotation after it has been started in either direction.

The current I_3 will produce a leakage flux ϕ_{11} magnetizing along the axis YY. At the instant indicated by the axis AA in Fig. 43, ϕ_1 and ϕ_{11} magnetize along the positive side of AA. The current I_{m4} in space quadrature with ϕ_1, ϕ_{11} magnetizes along the negative side of AA. Fig. 47 shows ϕ_1, ϕ_{11} and I_{m4} in space at the instant given by the line AA. It is seen from Fig. 47 that ϕ_{11} and ϕ_1, together with I_{m4}, produce a torque in the opposite direction to the main torque due to ϕ_4 and I_3. The torque ϕ_1, ϕ_{11}, I_{m4} is small, since I_{m4} is a magnetizing current only and ϕ_{11} a leakage flux only. The torque ϕ_1, ϕ_{11}, I_{m4} is small compared to the main torque I_3, ϕ_4, since I_{m4} is small in normal machines, but may become important in machines designed to operate with large air gaps or high air-gap density because then I_{m4} may become relatively large.

(d) Secondary Current During Normal Operation. Considering first the no-load or free-running condition, it is to be noted that according to equation

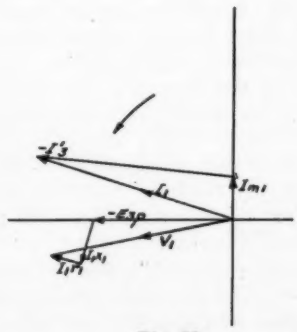


Fig. 50.

(75) ϕ_1 is approximately equal to ϕ_4, hence I_{m4} will be of about the same order as I_{m1} and E_{2p} will be smaller than E_{2r} by just such an amount as is necessary to force the current I_{m4} through the impedance of the rotor windings. But E_{3r} will bear the same relation

to E_{3p} as E_{2p} to E_{2r}, as can be seen from Fig. 43, hence any current along the XX axis will also appear in the YY axis and will also appear in the stator winding.

The free-running current of the single-phase motor will be about twice the magnetizing current I_{m1}. This is in accord with the experience that when one phase of a free-running two-phase motor is opened, the no-load current practically doubles.

Consider next the motor loaded. Barring leakage, the emf's E_{3r} and E_{3p} combine to the resultant $\overline{OM}$ (see Fig. 43).

E_{3p} can be calculated from equation (70)

$$E_{3p} = 2\sqrt{2} f w_2 \phi_1 10^{-2} \text{ volts} \quad \ldots\ldots\ldots\ldots (76)$$

and $$E_{3r} = 2\sqrt{2} f_r w_2 \phi_4 10^{-2} \text{ volts} \quad \ldots\ldots\ldots\ldots (77)$$

but according to (75) $$\phi_4 = (f_r/f)\phi_1 \quad \ldots\ldots\ldots\ldots (78)$$

hence $$E_{3r} = 2\sqrt{2}(f_r^2/f) w_2 \phi_1 10^{-2} \quad \ldots\ldots\ldots\ldots (79)$$

or $$E_{3r} = (f_r/f)^2 E_{3p} \quad \ldots\ldots\ldots\ldots (80)$$

But from Fig. 43 we note that E_{3p} is nearly in phase with E_{3r} and we can write

$$\overline{OM} = E_{3p} - E_{3r} = E_{3p}[1 - (f_r/f)^2] \quad \ldots (81)$$

The effect of the secondary leakage flux which is so helpful in improving the power-factor of the polyphase induction motor with increase in speed will be now considered in the operation of single-phase induction motors.

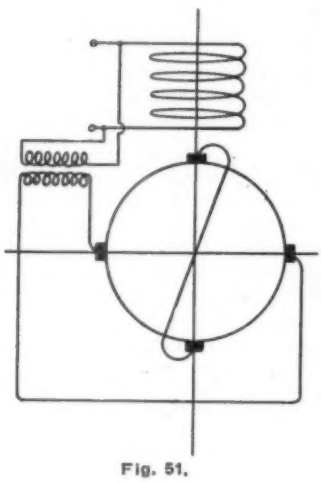


Fig. 51.

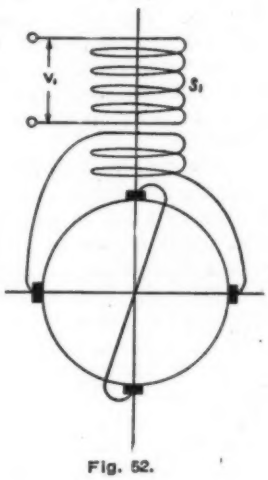


Fig. 52.

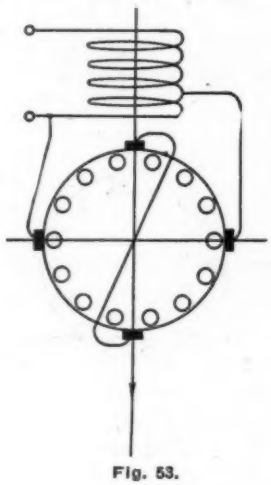


Fig. 53.

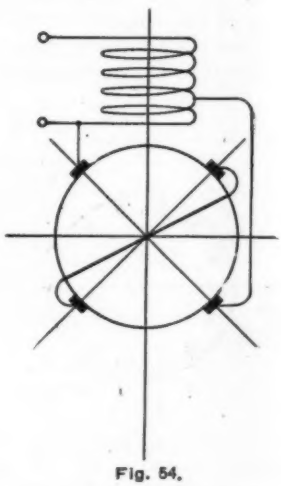


Fig. 54.

In Fig. 48 the vectors ϕ_1, E_{3p} and E_{2r} have been drawn in the same way as in Fig. 43 and it has been assumed that the load current I_3 has the direction shown in Fig. 48. It will be noticed that the current I_3 produces a leakage flux ϕ_{11} magnetizing along YY in a negative direction as shown in Fig. 49. The rotor conductors cutting the flux ϕ_{11} generate in the axis XX by rotation, an emf. E_{2r1} magnetizing along a positive axis, as shown in Fig. 49. We will plot E_{2r1} parallel to the direction of I_3 and having a positive component along the axis YY, as shown in Fig. 48. The resultant $\overline{OP}$ of E_{2r} and E_{2r1} will produce the flux ϕ_4 along the XX axis.

$\overline{OP}$ is the emf. responsible for the magnetization along the XX axis and takes the place of the primary emf. V_4 in the case of the polyphase induction motor. It can be seen from Fig. 32* that the flux lags by more than 90° behind the emf. V_4 producing ϕ_4. Hence the flux ϕ_4 produced by the emf. $\overline{OP}$ will lag by more than 90° behind $\overline{OP}$ and has so been plotted in Fig. 48. The emf. E_{3r} generated by the rotation of the rotor conductors in the flux ϕ_4 will be in time phase with ϕ_4, as shown in the time-phase diagram, Fig. 48.

The emf's E_{3p} and E_{3r} acting along the YY axis combine to the resultant emf. $\overline{OM}$, which in turn acting on the rotor impedance gives rise to the load current I_3 as is clearly shown in Fig. 48.

It will be seen that $\overline{OM}$ and I_3 in Fig. 48 are leading the corresponding quantities in Fig. 43.

The primary current I_1 is the geometrical sum of I_{m1} and $-I'_3$, as shown in Fig. 50.

The primary voltage V_1 impressed upon the coil S_1 is the resultant of $-E_{3p}$, $I_1 x_1$ and $I_1 r_1$, as shown in Fig. 50.

Since r_2 and x_2 are machine constants, it can be easily seen how the phase displacement between I_1 and V_1, or the motor power-factor, depends upon the position of the resultant emf. $\overline{OM}$. The more $\overline{OM}$ leads E_{3p} the better the power-factor of the motor will be.

We see then that there are two potent factors tending to improve the power-factor of the single-phase induction motor. One is the emf. E_{2r1} generated by the rotation of the rotor conductors in the leakage flux of the rotor load current I_3 and the other is the fact that ϕ_4 leads by more than 90° the emf. E_{2r}.

It follows from Fig. 48 that the performance of the single-phase motor is improved if the two fluxes ϕ_1 and ϕ_4 are displaced in time by less than 90°, for not only is the power-factor improved, but the torque-producing vectors ϕ_4 and I_3 are brought into a better time-phase position for exerting torque.

By providing the rotor with a commutator and supplying an emf. of the same phase as the line to the rotor along an axis displaced in space by 90° from the stator axis (see Fig. 51) the phase of OP and ϕ_4 in Fig. 48 can be changed as desired. It will be seen from Fig. 48 that from a torque point of view the power-factor compensation should not be pushed further than bringing ϕ_4 and I_3 in the same line.

According to the rotary-field theory we should expect that the motor performance would be best when the fluxes ϕ_1 and ϕ_4 are in time and space quadrature. That this is not the case is clear from what has been said and a slightly elliptical field is to be preferred.

Figs. 52, 53 and 54 show other types of self-excited, compensated, shunt, single-phase induction motors.

(To be continued.)

*ELECTRICAL REVIEW, Jan. 11, 1919, page 54.

Electric Lighting Plants Among the Essentials on the Modern Farm

How Living Conditions Have Improved on the Farm —Farmer Wants Electrical Conveniences and Will Pay Freely for Them —Selection of Suitable Plant

By GEORGE W. HILL

This is the second article of a series in which Mr. Hill points out how the electrical industry can profit from the sale and installation of electric light and power plants. Mr. Hill is well known among electrical contractors and dealers and has had extensive and very successful experience in selling such plants to farmers. The first article of this series appeared in ELECTRICAL REVIEW *of Nov. 30, 1918. Several other articles are to follow.*

THE fact that in recent years the American farmer has come to recognize the necessity of improving conditions on his farm, not only to make the farm more comfortable and attractive to himself and family but to attract desirable labor both inside and out, to the farm, has resulted in the sale of thousands of electric lighting and power plants. The "back to the farm" campaign has had its effect in showing the desirability of the farm as not only a place to make money, but as the place that provides the most wholesome environment in which to live and raise a family.

Recent developments, such as the World War, have enhanced the value of farm products to the extent that it is no longer a question of how to make money on the farm but a problem of increasing acreage and securing adequate means for planting, caring for and harvesting the crop.

Not so many years ago the farm was looked upon as a place of discomfort and drudgery from one year's end to the other owing largely to the lack of the modern facilities one finds in the cities. Many of the former disadvantages and undesirable features have been eliminated thanks to the great strides which have been made in the development of transportation, communication, education and of comfort and utility devices.

The educational advantages offered by the community school in some sections are almost inestimable in that the country children may remain at home and yet receive the advantages offered by a higher and better education.

The automobile has played an important part in closing up the wide gap between the farmer and the city folk. The farmer who once lived 20 miles from town and who consumed the greater part of a day in going to town and returning home now lives less than an hour from town since the general use of the automobile. The large cities with their many advantages, primarily perhaps, of education and entertainment, have been moved to within a very short distance in time from the farms. This has increased the production as it saves so much time. Farmers go to town more often perhaps but in doing so the time required is so short as compared with the "Old Dobbin" method that they are able to do more productive work in the field and still go to town more often. They not only remain in the field longer but in case of a breakdown of an important piece of machinery they are able, if necessary, to travel great distances in securing the parts needed and return home quickly. The time element on a farm in certain seasons of the year means much to the farmer, therefore the automobile has come to be recognized not only as a comfort and luxury but as a great convenience and time saver to the hustling American farmer.

The rural telephone lines traversing practically every crossroad in the agricultural districts have played a very important part toward bettering living conditions and saving time. News of the current events and market reports are now as accessible to the farmer as to the city folk and the dealer. Sociability among the country people and among communities has been greatly increased by the rural telephone and the automobile. Those who seemed years ago to be practically out of reach are now considered neighbors. Their voices are heard almost daily over the telephone and they are frequently personally called upon by their friends living only fifty miles away. Thus we see that the telephone and automobile have without a doubt made the farm a desirable place to live.

The American farmer is buying conveniences and time-saving devices as he wishes to continue to serve his country to the utmost and he is diligently weeding out of his schedule every slacker moment and making his time and energy count for more production, both from a patriotic and profit-making standpoint. Food, bullets, and dollars were vital factors in winning the war, but time seems to be the foundation, as food must be had in enormous quantities to feed the world and conservation of time means more production. So important an element was time considered that our national Congress has seen fit to set the millions of clocks and watches in America ahead one hour in the spring to get an extra hour of useful daylight.

With every modern convenience and educational advantage within reach of the farmer there seems little excuse for him to rent his farm and move to town. The inventive brains and immense capital of this country have been so engrossed with the idea of bettering living conditions and producing labor-saving devices in our great industrial centers, that up to quite recently the rural districts were neglected. We were not considering so much in days gone by what a powerful factor the farmer was in peace and in war. It seems that until the war called for millions

of our producers there was not much attention paid to the farmer, but when it became apparent that we were to have a general shortage of foodstuff the whole world cried out in no uncertain tones, "Speed up farm production." Every nerve was being strained at this time to assist the farmer. Men and women who had been giving freely of their talents and energy to the industrial world were bending every effort to help the farmer.

Call for Electric Service on the Farm.

Among other things it was first thought that the different public service corporations were to be looked to in order to carry one more comfort and convenience to the farmer—that of electric light and power—but the promoters of this idea were not given much encouragement when it began to be understood that the average farmer did not take very kindly to dealing with public service corporations. It was also found in a major portion of the agricultural districts that the distance between consumers was so great that it was not considered by many to be a paying investment to build many miles of electric circuits for a relatively small load. Therefore it has been more or less difficult to find capital for such projects. It is true that in some of the more thickly populated districts, where farms were small and towns short distances from each other this idea was worked out to a more or less satisfactory degree. Abnormal conditions arose with the war, and those who had contemplated service line extensions were compelled to abandon them.

Consequently the task of providing the farmer with the much needed electric light and power has been left largely to producers of individual power and electric lighting plants. Then it was that numerous manufacturers worked as perhaps they had never been called upon to do before in order to design and produce plants, which would supply the farmer with electric current, conveniently, durably and economically.

Some Features of the Farm Plant Problem.

It is the writer's opinion that among the earlier efforts to supply plants many of the concerns underestimated the actual requirements of the farmer in this regard, assuming in many instances that he wanted light and light only, while as a matter of fact power transmission was the farmer's greatest problem. His buildings are usually scattered and mechanical power transmission is practically out of the question, while with a plant with a suitable engine, and a generator large enough in electrical capacity he is able to transmit power to his various buildings.

Many of the earlier plants were of sufficient capacity to charge a small storage battery and burn a few lights of small wattage consumption. An attempt has been made to operate motor-driven machinery with these smaller plants in many instances with disappointing results, as the amount of power required to operate many of the machines on a farm is much in excess of the generator capacity and it required the combined capacity of the dynamo and battery to do the work with the result that the batteries were insufficiently charged and therefore had a short life. It is nothing uncommon today to find farms wired for from 30 to 60 lights, and we usually find on such farms small feed grinders, corn dumps, small elevators, milking machines, cream separators, deep-well pumps, etc., requiring considerable more power than that generated by some of the smaller dynamos which were at first thought sufficient to handle the farmer's requirements.

The question of suitable battery design has been a problem with many manufacturers. In very few instances do the plant manufacturers make their own batteries. In placing a storage battery in the hands of the non-electrical man it must necessarily withstand a large amount of electrical and mechanical misuse. It could be expected that the farmer would give the stortage battery the same expert care and attention which it would receive at the hands of a trained battery expert, consequently many of the first batteries gave poor satisfaction and were of comparatively short life, due largely to the fact that many of them were too small in ampere-hour capacity and to a lack of proper care and attention on the part of the operators. Not enough effort was made in teaching the farmer the care and attention which his battery should have either by personal instruction or by placing in his hands elementary printed instructions which would enable him to understand the care and operation of a battery.

Storage Batteries for Farm Use.

The most common storage battery being used today with farm lighting plants is what is known as the lead battery of pasted plate type. There are only two types of battery in common use: the lead and the nickel-iron or Edison battery. The lead battery is divided into distinct classes. The Faure or pasted plate type and the Plante or chemically formed plate type. Opinion is somewhat divided as to which of the two common types of battery, the lead or the Edison, is the best adapted for farm lighting. Both have individual characteristics which are advantageous in certain conditions. There are desirable features in both types. The Plante lead battery is shipped unassembled (knocked down) and must be assembled on the job; this requires considerable time and attention before and while giving it the initial charge. The Faure or pasted lead battery and the Edison battery are shipped assembled and ready for use immediately upon installation. The Plante lead plate battery is the long-life battery of the lead family but has several disadvantages, aside from that already mentioned, as compared with the pasted plate battery for farm lighting. It is claimed by the manufacturers of the Edison battery that it has a much longer life than any lead type battery, but its chief disadvantage is higher cost as compared with the lead battery.

Manufacturers today are carrying on an educational campaign through lecture courses, literature, instruction books and cards on the subject of the care and operation of storage batteries so that today we can expect a battery placed in the hands of the reasonably careful farmer to produce almost ideal results regardless of the types of battery.

Features to Notice in Selecting a Plant.

In the selection of an electric power and lighting plant for farm use there are a few points to consider carefully. Among these are size and type of engine, size and type of generator and battery, switchboard conveniences. All of the equipment should be simple and non-mysterious.

The engine should have mechanical power in excess of the power required to charge the storage battery. In other words, the power of the engine should be in excess of the wattage required to charge the battery in order to be able to take care of any motor-driven machine that is run while the battery is being

charged, or of any mechanical load which may be nearby and operated by the engine by means of a line shaft and belting.

The generating capacity should be large enough to charge the battery and furnish electric current for operating motorized machines, flatirons and other electrical appliances. Care should be exercised to ascertain (if possible) the greatest wattage consumption that may be expected at certain periods of the 24-hour day in order to be able to select a generator large enough to take care of this without requiring the battery to assist to any great extent in running of power or heating devices.

If the battery is used for just what it is intended it should be used for, that is, to furnish electric current when low ampere discharges are required, such as burning a reasonable number of lights, running an electric fan or other small device, very satisfactory results will be secured from any standard battery, both from the standpoint of life and efficiency.

The switchboard should be simple in design, providing a means of starting and stopping the plant manually and automatically, perhaps, yet it should be so constructed as not to be called a highly automatic device, for with such automatic devices we usually find considerable complications and mysteriously operated features not usually understood.

With relation to the engine, there are numerous types of internal-combustion engines on the market and the farmer will no doubt be guided largely in his solution of an engine by the experience which he has had with engines both for farm work and in his automobile. Nearly all of the plants of any particular note are equipped with 4-cycle poppet-valve, single-cylinder, splash-oiled, roller and ball-bearing engines. There are many more water than air-cooled engines used on farms, yet there are air-cooled engines produced and used which have given very good satisfaction and have proved to be practical and durable.

A large majority of the plants on the market are equipped with Atwater, Kent, Delco or similar ignition systems as the magneto has not proven very satisfactory in many ways principally perhaps because the magneto is a mystery to most people and frequently when out of order requires the services of experts who may not be conveniently located or secured.

The writer believes too many farmers buy on price rather than on capacity and construction and durability of the plant. Not many farmers are perfectly familiar with the numerous electrical terms and they leave the capacity, etc., largely to the agent who many times is afraid to recommend a plant of ample capacity for fear the higher price will lose the sale.

Present the Facts to the Farmer and Sell a Good Plant.

This is all wrong. Tell the farmer just what size to buy, if you know, and quote the price without a tremble. He is now accustomed to buying high-priced articles, such as automobiles, tractors, autotrucks,, threshing machines, etc., and your price on a good, large enough electric lighting plant will not scare him the least bit.

Don't be afraid to approach the farmer on the subject of buying an electric light plant. The time has come when every farm home is a suburban home and the farmer wants modern comforts and conveniences in order to keep abreast with his neighbors in the city.

In fact, he demands them. Electric light and power are available at a reasonable cost to him. The farmer may live just as comfortably as his city brothers and yet enjoy the blessings of a quiet country home at no great added expense.

All water and sanitary conveniences may be had. Electric power eliminates the awfulness of housecleaning. Thousands of electric vacuum cleaners are in successful operation in country homes. The buildings and grounds may be lighted with electricity and the whole atmosphere of the old home changed.

No matter where you may travel in the country you will find that the farmer is aware of the conveniences and utility offered by modern power devices. He knows and understands what such things will do for him. He knows that it improves living conditions and will in a short time pay for itself. Now it's up to us to carefully select a plant which we know and feel will meet his requirements and then go out and sell him.

SEATTLE PLANT FOR PRODUCING SEMI-DIESEL ENGINES.

All Machinery and Shop Tools Are Motor-Driven Requiring a Connected Load of 600 Hp.

The manufacture of semi-Diesel engines on a large scale at Seattle is destined to play a considerable part in the power problem on the Pacific Coast, especially as applied to the propulsion of ships. This refers to the plant, now practically completed, in that city of the Gulasen-Grei Engine Co., of Christiania, Norway, which has facilities for manufacturing engines of the aggregate capacity of 15,000 to 20,000 hp. per annum. The new plant, occupying about 6 acres, is situated on Lake Washington ship canal, in the Salmon Bay district. The investment, including cost of site, buildings, machinery and equipment, amounts to about $700,000.

The engines to be made are of a type similar to those made by this concern in Norway, consisting of the surface ignition design, used largely for marine duty, but likewise suitable for operating mills and pumps. Those planned for construction at the new plant will be of various sizes ranging from 15 to 360 hp., in which petroleum of 20 degrees gravity Baume or over, will be used. Each engine is to be equipped with a small electric generator for charging a storage battery to start the engine.

The foundry, machine shop, pattern shop and erecting floor, each occupying a separate building, are all equipped with electrically operated machines and tools, requiring about 40 motors and a connected load of approximately 600 hp., at 440 volts, three phase. The wiring of the buildings for power and lighting, providing for all outlets required, and connections, ran up to a cost of $25,000.

The foundry contains two Whiting 6-ton cupola furnaces, the blasts for which are supplied by blowers driven by electric motors. Also, two Monarch oil-burning brass furnaces, with motor-driven fans.

The large machines in the machine shop, such as the heavy lathes, radial drills and milling machines, are direct-connected by reduction gears to motors. All other machines and shop tools have electric group drive, in some cases by silent chain transmission. The machines in the pattern shop are likewise motor-driven through belting and counter shaft.

Six electric cranes, the Whiting 3-way type, of 5-ton to 20-ton capacity, serve the foundry, machine shop, erecting floor and sections of the plant. The crane over the erecting floor has a 40-ft. span.

The electric wiring and motor installations were put in by the Standard Electric Co. of Seattle.

Effect of Electric Stimulus Upon Potato Production

Experiments with Electroculture of Potatoes Extending Over a Two-Year Period Show Large Increase in Yield—Equipment Employed

AN INTERESTING series of experiments on the stimulation of plant growth has been carried on near Pontypridd, Wales, during the last two years on the field of the Star-Delta Potato Club, which is connected with the South Wales Electrical Power Distribution Co.

The field had an area of 2.07 acres (Fig. 1) and the soil consisted of a typical heavy loam, approximately 70% clay and 30% sand. In 1916 the field had grown oats, but in 1917, when taken over about March, it had been two-thirds plowed, which was completed, but no manure was used in 1917.

In March, 1918, 41 tons (20 tons per acre) of colliery manure was spread evenly over the field. In April the field was plowed once lengthwise, then harrowed and rolled. After this, 1120 lb. of 30% superphosphate and 280 lb. of sulphate of ammonia was spread over the surface. It was proposed then to cross-plow, but owing to difficulty in obtaining a plow, and also to the planting season being due, the growers were compelled to open planting drills and found only a fair tilth.

In 1917 potatoes were planted during the first week in May and were lifted in the first week in October with the following results*:

	Cwt. planted.	Cwt. lifted.	Ratio.
	48.5	292.87	6.0 to 1
King Edward	2	4.46	2.25 to 1
Irish Up-to-Date	20	81.7	4.0 to 1
King's President	19	171.0	9.0 to 1
Arran Chief	7.5	35.71	4.75 to 1

*Note: A British hundredweight (cwt.) is equivalent to 112 lb.

In 1918 potatoes were planted in the first week in May and lifted in the second and third weeks in October with the following results:

	Cwt. planted.	Cwt. lifted.	Ratio.
Templar from Loch Leven..	48.6	370.4	7.6 to 1

For the purpose of the experiments, 400-volt, 25-cycle, single-phase current was transformed by an oil-cooled, 10-kv-a. transformer to 32,000 volts, and rectified with a Delon type of rectifier, which held the voltage to 39,000 in dry weather and to 30,000 in the wettest weather. The apparatus gave no trouble at all and held this voltage in the heaviest rain.

The area under electroculture was divided as follows:

	1917.	1918.
Electrified area (acres)	1.21	1.096
Control area (acres)	0.86	0.977
Total	2.07	2.07

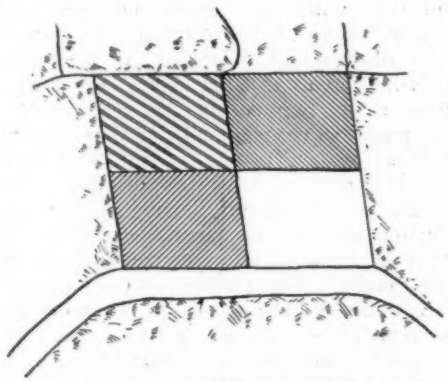
In 1917 the network consisted of 5850 yd. of No. 24 galvanized steel wire. The wires were spaced 6 ft. apart, with cross wires arranged to make a mesh 6 ft. square. These wires were supported from main copper carriers of No. 6. The network at first was supported on insulators about 6 ft. 6 in. from the ground; later, on Aug. 14, this distance was reduced to 5 ft.

In 1918, 1860 yards of the same size of wire was used, but the wires were spaced 9 ft. apart, without cross wires. The network was movable and was maintained as nearly as possible 2 ft. above the haulms.

The 1918 arrangement was at right angles to that of 1917.

In 1917 the voltage was measured by a Kelvin and White electrostatic voltmeter, reading to a maximum of 100,000 volts. In 1918 it was measured by a sphere gap, previously calibrated. For measuring the current a 0.100-volt, moving-coil voltmeter (with the resistance cut out) Ferranti direct-current instrument, calibrated as a milliammeter, was used. This instrument gave the polarity as well as the value of the current. The synchronous motor being four-pole, the polarity could be reversed if necessary by shifting the adjustable stationery arm of the rectifier a quarter revolution, but the network was kept positive. The ammeter was fixed on the negative.

As stated already, in 1917 the voltage varied from 39,000 volts in dry weather to 30,000 in wet weather. In 1918 it was 36,000 volts; and this did not vary 5% either way, the lower voltage being obtained during heavy rain and the higher during drier weather.



Plat of the Ground on Which Electroculture Experiments Were Conducted.

Lower left-hand section subject to electroculture in 1918. Upper right-hand section subject to electroculture in 1917. Upper left-hand section subject to electroculture during both years.

The current in 1917 varied from 2.5 milliamperes in dry weather 4.0 to 7.0 in wet weather. In 1918 it varied from 0.35 in very dry weather to 0.8 during heavy rain, with an average of 0.5 during the normal damp weather prevalent in the district.

Endeavor was made to keep the potential constant during the treatment, and it is interesting to note the lower readings during 1918, which may be accounted for by the smaller amount of wire used as compared with the previous season, the ratio being 3 to 1. Further, the insulators used during 1918 provided a smaller leakage path.

Treatment was usually given between the hours of 6 and 9 in the morning and 7 and 10 in the evening:

		Hours.
Commenced Aug. 10, 1917	(morning)	118
Finished Oct. 1, 1917	(evening)	164
Total		282
Commenced June 22, 1918	(morning)	294
Finished Sept. 27, 1918	(evening)	294
Total		588

The results of electroculture were as follows:

	1917		1918	
	Tons.	Tons per acre.	Tons.	Tons per acre.
Electrified	9.1	7.5	10.3	9.46
Control	5.5	6.4	8.2	8.40
	Increase	17.2%	Increase	12.6%

Note.—The long ton of 2240 lb. is referred to.

The apparatus never failed and was successful throughout, although difficulty was expected in keeping the network charged during heavy rain. On dark nights it was easy to see the glowing network wires. In the rectifier hut grass grew extremely quickly through the rough flooring of old sleepers, especially under the voltmeter. In the dark the tips of the blades could be seen glowing, but, after some days, these went a dark brown, evidently showing that the discharge was too intense. Insects, such as butterflies, etc., were on many occasions observed, and it was noticed that when flying under the network they kept very close to the ground, or else flew back away from the wires. Insects that happened to alight on the wires in the hut could be seen glowing in the dark, and in most cases after the current was shut off they were found to be dead.

It was noticed in both seasons that the potato haulms under the network kept green much longer than those on the control portion.

Although the percentage increase in 1918 was less than in the previous year, it is to be noted that the total yield was increased from 14.6 tons to 18.5 tons, and although the treatment during 1917 only lasted seven weeks, as compared with three months during 1918, the decrease might be explained by the smaller area of network wire in 1918. It should also be noted however, that, owing to the network in 1918 being arranged at right angles to that of 1917, about one-quarter of the 1918 control portion had been under the network the previous year.

It was unfortunate that, owing to the weather being so wet during the gathering of the 1918 crop, it was not possible to weigh separately the potatoes taken from each quarter of the field.

COST OF EQUIPMENT.

Transformers of 10 kv-a. 400/120,000 volt	$1002.00
Three-hp. synchronous motor for rectifier	265.00
	$1267.00
Making rectifier arms, etc., approximately	200.00
	$1467.00

It is estimated that this equipment could easily deal with 100 to 150 acres.

TWO-ACRE VOLTAGE EQUIPMENT.

Galvanized steel wire	$11.70
Supporting wire, steel, approximately	9.70
Sapling poles, insulators	19.40
Labor, approximately	19.40
	$60.20

To warn people of the high voltage, a "Danger Notice" was kept at the gate of the field.

In an adjoining field an experiment was made in 1918 on a crop of oats, but owing to various difficulties it was not possible to carry it out thoroughly. The results seemed to point to an approximate increase of 35% in grain and an increase of 17% in straw.

CO-OPERATION WITH LOCAL DEALERS PRODUCES SATISFACTORY RESULTS.

Plan for Selling Gas Appliances Suggests Possibilities for Sale of Electrical Goods.

A merchandising policy which might be imitated to advantage by many central-station companies was put into effect during the past year by the Union Gas & Electric Co. of Bloomington, Ill., in regard to the sale of gas appliances. A year ago, considerable opposition was encountered from the local furniture and hardware dealers and plumbers in the efforts of the company to introduce these appliances as these dealers still believed it their function to sell coal heaters and that the use of gas encroached upon their market.

To meet this opposition a plan of co-operation was worked out by the company's commercial department in which the local dealer was given an opportunity to get a very good share of the gas appliance business with a substantial profit. According to this plan the dealer sells the appliances from the company's stock, the price to the dealer including the cost of connection up to a certain limit. A similar arrangement was made with the plumbing concerns in regard to water heaters, the only difference being that in this case the plumbers make the necessary connections.

These plans have so far produced very desirable results. At present, two of the largest dealers in Bloomington are handling gas stoves, ranges and heaters exclusively and the master plumbers have pledged themselves not to sell coal water heaters where it is possible to sell a gas apparatus. An additional feature of this plan is that it insures the installation of high-grade goods of standard types for which repair parts are easily obtainable or are carried in stock by the company.

ADVERTISING LAWS OF MISSOURI TO BE RIGIDLY ENFORCED.

Kansas City Advertising Men Move to Eliminate False and Misleading Advertisements.

With the greater facilities for the exploitation of electric material during the present year, dealers will be glad to learn that they will have a champion in the elimination of false and misleading advertising in the Missouri press. The law in this particular is very stringent and the Protective Bureau of Kansas City, the vigilance committee of the Advertising club, has taken steps for its more rigid enforcement. It has secured the services of Capt. George M. Husser, who since 1917 has been secretary of the National Vigilance Committee. He secured his discharge when the armistice was signed and will devote his whole time to the investigation of advertising which is off-color. During the past year the Bureau has done much good work under the direction of Oliver Wroughton, secretary of the Graphic Arts organization, assisted by volunteers from the Advertising club but it was felt that during 1919 it would be necessary to place the business in the hands of one man who could devote his whole time to it.

Editorial Comment

Large-Scale Electric Cooking

THE shortage of coal and natural gas, the nation-wide demand that foodstuffs be conserved, and the scarcity of hired help coupled with the additional time given up by the women at home to work in the Red Cross and similar callings, combined during the past year or so to give a very real impetus to electric cooking. In those localities where hydroelectric energy is available even more rapid adoption of the electric oven and range has occurred, not for the above reasons alone but because of the greater convenience and healthiness of electricity over gas and especially coal.

Hitherto, the attention of the central stations has been mainly directed to the domestic cooking field for developing the electric cooking load. In doing this they have had to face heavy odds in the way of comparatively high cost of ovens and ranges as compared with those for coal and gas; relatively high installation expense for equipment; rather limited use for such an installation; and an energy rate that if not tending to place convenience and eventual economy at a disadvantage, at least makes the electric range appear somewhat more of a luxury than a necessity.

There is a field, however, where electric cooking equipment should and may compete very much more easily against coal and gas than is the case in the domestic field. That field comprises the hotels and restaurants, cafes and canteens and clubs—the commercial field, heavy cooking. It would appear, *a priori*, and the more thought is given this matter the more it appears to be the case, that domestic electric cooking when it comes will come after the commercial field has been won over. In the hotel, the club, the restaurant and canteen, the higher cost of the electrical installation as compared with that for coal or gas does not assume the importance that it does with the domestic installation. The load-factor of the former is higher, hence the advantages of electric cooking have greater opportunity to be capitalized. And the labor question, economy of foodstuffs, uniformity of results and the simplicity of obtaining them become even more prominent features than is the case in the home.

In Great Britain the servant and labor problem became so acute during the war that a number of large establishments were forced to take to electric cooking for this reason alone. That condition is becoming more and more one with us. Gas is deteriorating in quality and indications are that its sale on a thermal unit basis will be the rule rather than the exception throughout the country before many months have gone, another factor that should help electric cooking along. Low pressures and freezing are also allies of the electric range.

The central stations that win over the commercial establishments to electric cooking will find that the domestic kitchens will come in course of time. The former are, at present, better able to take advantage of heat made electrically than the latter, as a general rule. And the load of the larger establishments is a more desirable one, of greater magnitude and of higher load-factor than of the smaller domestic establishments, making the energy charge lower while their location is more favorable for installation and service.

There is another field for electric cooking which we advocate for all the reasons advocated for domestic and commercial cooking with another very strong reason—that of safety to life. More than one train wreck has ended in tragedy because the coal fires of locomotive or restaurant car started a conflagration which resulted in loss of life. We want to see electric cooking replace cooking by oil or coal on all trains.

The war, creating as it did an urgent demand for cooking electrically, also imposed difficulties and restrictions on account of materials and labor shortage that prevented the demand being met as it might otherwise have been. Now that conditions are beginning to improve we hope the electric appliance manufacturers and the central stations will work together and push electric commercial and domestic cooking for all it is worth, and it is worth a very great deal. The opportunity is there, the time is here, for the one to increase their sales, the other to increase their output and fill in a part of the valleys in their load curves. The opportunity is one that should be utilized to the full, now, while every factor in our domestic, commercial and national life is working to the same end.

Some Operating Problems

NOW that the stress of war is over it is to be hoped that many of the interesting and pressing operating problems facing central-station and transmission companies will come again to the fore. It has been a matter of keeping going the last year or two rather than of trying new methods or new ways of doing old things. Things that were dropped to wage war should now be taken up and prosecuted to the full, the lessons and experiences learned in the last months should be applied and made permanent for better utilization of equipment and investment and higher operating reliability, flexibility and economy.

The seasonal variation in capacity of underground cables often imposes operating difficulties as well as

financial objections. Methods of extending the summer current-carrying capacity of underground conductors so as to reduce the usual 15 to 35% difference compared to their winter rating is an important subject. This has been accomplished in some instances by applying forced or natural ventilation, and by the circulation of water through the cable ducts. In other cases where dielectric failures occurred due to cumulative effect of copper and dielectric losses, the resistance of the latter decreasing with increasing temperature, taking potential off the line at definite periods sufficed to keep a cable from breaking down, where previously taking off the load but leaving the potential on did not mitigate dielectric failures. The investment in underground distributing and transmission system is so great that one of the important problems today is to reduce the difference between the summer and winter capacity, improving thereby the flexibility of the system and enabling the investment to be lower while earning greater return.

The automatic attendantless hydroelectric plant and substation, no longer in the experimental stage, could afford to be adopted upon a wider scale than is at present the case. The relatively high proportion of operating cost represented by labor stands in the way of making many a small-power low-head hydroelectric development a profitable proposition. The automatic distantly or automatically controlled plant overcomes this. The automatic synchronous converter and motor-generator sets for interurban trolley service and for industrial plants have been tried, found entirely satisfactory, and all that remains is for more companies to take to them. Another field in this connection is the attendantless automatic synchronous motor installation for improving voltage regulation and power-factor correction on both long high-voltage lines and in heavily loaded congested networks. The static condenser accomplishes this same result, in part, but less flexibly, improving rather than correcting for power-factor, and the few installations made in this country have so far given good accounts of themselves.

The protection of intricate transmission networks from short-circuits is not yet altogether solved in practice. The installation and design of the entire network for reverse-power relays for correct selective protection with predeterminable results can hardly be called as yet an actual fact. However, the more pains taken and the more thorough the investigation of a system made, the greater the assurance that when trouble arises the calculated relay setting values and choice of locations will be found correct. This problem is really more difficult than at first supposed, because of the intricacies of the modern transmission network with its interconnected power plants, large number of lines and tie-lines and substations in parallel and interconnected through ring and radial systems. The problem depends not only upon the magnitude of current, which in turn is dependent upon resistance, reactance, momentum of rotating apparatus and stored energy of the system, but also upon the element of time of relays, circuit-breakers, oil switches, etc.

These are only a few of the many operating problems that await the attention of the operating engineer now that there is opportunity. They are problems that consist of bettering existing conditions with existing equipment improved and differently applied.

Important Subjccts Before Electrical Inspectors

ON JANUARY 28, 29 and 30, the Western Association of Electrical Inspectors will hold its fourteenth annual meeting in Chicago. The meetings of this organization are always live, well-attended meetings, full of interest and rich in results for furthering safe and sane electrical wiring.

This year's meeting will, it is expected, be no exception to the rule. Rather, is it expected to be one of particular significance, for the work taken up during the past year was of considerable magnitude, and the work planned for the coming year comprises an ambitious program. Among the more important matters to come up for discussion are those dealing with the standardization of fittings and materials, the combined National Fire and Safety Code, and the reports of the various committees.

Among the latter, one is especially deserving of consideration as it is of vital importance to the industry. This is the report of the committee on the advisability of determining the size of copper conductors from the maximum demand and nature of the load rather than from the connected load only. This question is not a new one, as it has come up at previous meetings of the Western Association of Electrical Inspectors and other similar organizations, but action was deferred on these occasions on account of lack of definite information. During the past year, however, extensive tests have been carried on by Victor H. Tousley and Henry C. Horstmann, which have brought out considerable valuable data in this respect. This information will be presented at the meeting with the result, it is believed, that more definite action will now be taken in this important matter.

Altogether, the forthcoming annual meeting of the Western Association of Electrical Inspectors promises to be of very real interest and of great importance in promoting the application of electricity.

Awakening Mutual Responsibility

AS HAS been stated in these columns, one of the real problems of the day is to bring the employer and employe together into closer harmony and better understanding of the needs of each and the need of each for the other. With the increase in the size of organizations, the fellowship and personal contact possible and common fifty years ago is no longer feasible, and each worker becomes more and

more a number, an integer, a cog in the wheel of the industrial process.

In these times of strange happenings in world affairs, of world democracy, of unionism and powerful affiliations and combinations, thinkers and students of the times see tendencies that create many forebodings and must view with alarm the growing discontent of the working classes. Discontent there is among the working classes, unfairness unfortunately too often being the seed that grows to radicalism, syndicalism and unrest.

One of the crying needs of the day is to create in the mind of the employer just as also in the mind of the employe, the mutual responsibility of each to the other. When this is done, most of the strife in the labor world will disappear. It is lack of appreciation of the mutual responsibility of employer and employe, each to the other, that is largely responsible for causing strikes, breeding bolshevism and bringing about enmity where there should be friendship, suspicion where there should be frank and honest understanding, opposition instead of co-operation. Today there is urgent need in the industrial world to bring about the awakening of mutual responsibility of employer and employe.

As we have already said, each employe is a cog in the wheel that makes up an efficient and successful productive whole. The value of an employe to himself and to him that pays his hire depends very largely upon the interest with which he does his work, the skill with which he does it. Two factors contribute to this interest and skill, the efficiency of the worker. One of these is the inducement, the reward, the remuneration. The other is interest in the work. The former implies a living and worthy wage, and possibly a wage depending upon the results or profit sharing. The latter means work for which one is adapted performed under fit conditions.

Elsewhere in this issue reference is made to a method employed by one very large employer of labor to interest its workers in their work by showing each the part they play in the whole. Doing so awakens the responsibility of the individual to the whole, bringing home the realization that each link in the chain—each individual—counts, is of importance however apparently menial the job. Such a policy is wise, and the way this policy in the case referred to was carried out is also of interest. When employer and employe understand each other, take an interest in each other and work together, the discontent of so many workers with their lot will disappear.

Intensive Horticulture by Electric Stimulus

GREAT BRITAIN commenced to devote wholehearted and serious attention to the production of foodstuffs at home when the submarine menace and the scarcity of ocean-going bottoms for the shipment of provisions loomed up in threatening proportions. While many and varied were the methods advocated, and in part employed, to make the island self-supporting, one method is of special interest to the electrical industry, namely that of electroculture. Much has been done in the past in the way of stimulating plant life by electrolysis, by electrical discharge and ionization, and by the application of various rays. While these experiments have, perhaps, been of academic rather than practical interest they have served to bring out the possibilities or fallacies of the various theories and practices.

Elsewhere in this issue appears a short account of some experiments made to determine the effect of ionization or high-voltage direct-current discharge upon the yield of potatoes. The experiments were carried out upon the property of a public utility, and under its direction. The results obtained are worthy of note. The first year the tonnage of potatoes per acre was increased 17.2% by electric stimulus. The second year the increased yield due to electric stimulus was 12.6%, but with a different arrangement of overhead conductors and unfavorable weather conditions. In an adjacent field a crop of oats gave a 35% greater yield of grain with a 17% increase of straw under the influence of electroculture. Energy was on the network between 6 and 9 in the morning and 7 and 10 in the evening, both periods being favorable for filling up the valley in the load curve without augmenting the peak which does not occur in the summer months in any case.

Apart from the increased yield accompanying electroculture, it was found that crops beaten down by rain and wind revived rapidly when subjected to electric stimulus. The only deleterious effect of electric stimulus seems to be that weeds, like crops, grow and thrive under the influence of electroculture; this, however, is practically true in any intensification of the growth.

The installation cost about $1500, at war prices, and was capable of stimulating about 150 acres. Against the expense of capital cost should be deducted the saving in cost of labor, and perhaps cost of land otherwise required for an equivalent crop. Deducting the cost of energy from the higher sales value of the crop because of its superior quality plus the larger crop available for sale leaves a balance that is pure profit.

We do not believe that electroculture will be used to any extent in the United States for many a year, except perhaps in small market gardens situated close to their city markets. We do feel, however, that the central-station companies, many of whom have large tracts of land around their power plants which are available for horticulture and are often used by company employes for such a purpose, might take an interest in electroculture, from the academic aspect rather than of load building. The more the subject is studied the more fascinating it becomes, and there is no knowing where it will lead. Let some of the utilities try it.

Week's Events

Engineers' War Activities Shown—Employment Bureau for Engineers—Western Electric Movies—Power Club Meets

GRAPHIC PRESENTATION OF ENGINEERS' PART IN THE WAR.

Brig.-Gen. J. J. Morrow, Chief of Engineers, First Army, A. E. F., Addresses Annual Meeting of Western Society of Engineers.

A modest but very thrilling presentation of the work done by the engineering branches of the American Army in France was presented at the fiftieth annual meeting and dinner of the Western Society of Engineers held in Chicago on the evening of Jan. 22. The speaker of the occasion was Brig.-Gen. J. J. Morrow, Chief of Engineers, of the First Army, American Expeditionary Forces. Although he had only 48 hours' notice that he was to speak, he gave a vivid and fairly comprehensive picture of the problem of organization of the engineering troops and of the splendid work they had accomplished.

Soon after General Pershing and his staff arrived in France there came nine regiments of engineers, later followed by railroad and other construction troops. These were engaged in preparing facilities for the big American army that was to follow. A very carefully worked out organization scheme was adopted and strenuous work was undertaken in the building or rebuilding of port facilities, railroads, storage depots, refrigerating plants, special training schools, shelters for troops, prison camps, remount stations, hospitals, forts, etc. The plans made were very comprehensive, it being intended to provide very adequately for every branch of the army, the bulk of which was to be brought over in the spring of this year. The big German drive begun March 21, 1918, caused a material cutting down of these plans and necessitated intensive preparatory work for the troops that were so urgently needed in the early part of last summer to stem the boche tide.

Among the projects undertaken by this preliminary construction was the installation of power plants and water supply systems in many parts of France where the American troops were to be quartered. Among these was the largest cold-storage plant in the world. A number of gasoline and oil-storage stations were built. Extensive railroad and road building was undertaken. Much of the material had to be prepared by the engineer troops; the forestry division cut the timber and was turning out an increasing amount of lumber in its own sawmills, in the latter months the output being 80,000,000 board feet a month. This work was made especially difficult because of the rigid forestry regulations of the French Government. The speed and equipment of the American sawmills proved quite a novelty to the French. Considerable of the cement that was needed was manufactured near the spot. To save transport space, purchases of army supplies were made in Europe, something over 1,000,000 tons being secured in this way. The camouflage division was an important one in making cover for guns and other military works. A large map-making division that turned out an enormous number of maps and other printed matter was created. The searchlight division prepared equipment for aid in aerial warfare.

General Morrow explained the organization of the engineering divisions. One regiment of engineers, about 1600 men, accompanied each division of about 25,000. A corps was composed of from three to six divisions with one special sapper regiment and a number of pioneer troops. An army was composed of from two to seven corps, with several special regiments of forestry, railroad, pioneer, power and mechanical, searchlight, miners, gas and flame, and labor troops. For an army consisting of about 750,000 there were about 65,000 engineer troops.

He spoke in some detail of how he was called from the Panama Canal to undertake the organization of the engineers for the First Army, one of the first tasks being the engineering work of building roads and bridges in the neighborhood of Chateau Thierry. From that time on the engineers were under fire almost constantly. In preparation for the drive that wiped out the St. Mihiel salient, careful preliminary work had been made but in the following attacks in the Argonne Forest insufficient time was available and the work had to be rushed so that in many instances the men worked steadily for 17 to 27 hours without rest. About the middle of last October there were some 45,000 engineer troops with the First Army, of whom there were only six officers who had had previous experience in army engineering work, the rest of the organization being composed entirely of drafted men, many of whom had only three months' training. The extraordinary difficulties of the terrain in the Argonne district were dwelt on, this being a mass of shell holes that resulted from the violent attack on Verdun which the French had so brilliantly defended in the long battle of ten months. A feature of this heroic French defense was that, although the two railroads supplying Verdun had been destroyed, all of the supplies were brought in by truck over one highway for whose maintenance an army was set apart that lost many men from being run over by the speeding motor trucks between which they had to keep the road in repair.

General Morrow showed several hundred views of the engineering work done in France, these including construction at ports, railroad work, road building, forestry work, bridge building, camouflage erection, etc. For some of the road work the material used consisted of the debris of nearby demolished villages that had to be carried in sand bags. In conclusion, he pointed out what he thought were important lessons to the engineers of the United States. He felt that every engineer should fit himself for any possible similar national emergency. He should especially train himself to take care of himself and any men under him; he should develop discipline and accuracy in understanding and executing orders just as they are given.

He must also remember that, although in civilian life the engineer looks first to cost and then to time of execution, in war the order of importance is exactly the reverse.

Following the address of General Morrow was a beautifully illustrated lecture by Dr. R. A. White on "War Conditions on the Western Front." He gave a very vivid account of the trip he made to the Allied fronts in Belgium and France last summer, contrasting the conditions he found in the devastated regions with the beautiful landscapes that had existed before the war. In considerable detail he referred to personal visits with the troops, close to and behind the firing lines, in their rest camps and in the hospitals.

Preceding these two speakers were the more formal exercises of the Society, including announcing the award of the Chanute Medal to B. H. Peck for presenting the best paper on engineering, this being entitled "Engineering Data Necessary for an Electric Rate Determination"; also announcement of the presentation of the Washington Award to Herbert C. Hoover, international food administrator and formerly consulting engineer. Retiring-president Charles D. Burdick made a brief address, dwelling on the fact that during the fifty years of the society's existence there had taken place the most wonderful developments in electricity, aeronautics and other branches of applied science. He spoke of the activities of the society during the preceding year, which, although a difficult one from the financial standpoint, had still resulted in a larger increase of membership than during any year in the last decade. About 17% of the society's membership had entered Government service during the war. Arrangements are being made to affiliate the society with the Engineering Council.

Announcement was made of the election of officers for this year as follows: President, A. S. Baldwin; first vice-president, Kempster B. Miller; second vice-president, William M. Kinney; third vice-president, J. L. Hecht; treasurer, C. R. Dart; trustee (for three years), E. T. Howson.

President A. S. Baldwin then took the chair and in a short address referred to this as being the period of big opportunities for engineers. The big work done by the engineers during the war has gained them fine public recognition. They should now take active part in the important work of reconstruction.

The meeting adjourned at 12:45 a. m.

ESTABLISHMENT OF ENGINEERING SOCIETIES EMPLOYMENT BUREAU.

Joint Employment Service for A. I. E. E., A. S. M. E., A. S. C. E. and A. I. M. E.

The employment service which has been maintained for many years by the Institute has satisfactorily met the demands upon it and has been greatly appreciated by the membership at large, many of whom have obtained desirable engagements through it. The individuals and industries seeking competent engineers have also been greatly benefited.

Similar effective service has been maintained by some of the other national engineering societies, and for some time the desirability of more closely co-ordinating the employment activities of these societies and broadening the scope of the service has been discussed, as a result of which the establishment of the Engineering Societies Employment Bureau under the direction of a Board of Management, consisting of the secretaries of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, was authorized by the Engineering Council, which is the instrument created by the four societies named above for the purpose of conducting activities of common interest.

In creating this joint bureau the Engineering Council turned over to the Board of Management the office equipment, records and operating staff of the American Engineering Service, a similar body organized by Engineering Council and representing several engineering societies, including the A. I. E. E., which had been engaged during the war in assisting the various branches of the Army, Navy and other governmental departments to obtain suitable engineering personnel.

The Bureau is especially needed in the period of readjustment upon which the country is just entering. One of its most important functions will be to aid engineers who have been in military service to find suitable engagements upon their return to civilian life.

The Bureau will not be conducted exclusively for the benefit of members of the societies named above; non-members who are properly introduced will also be registered. No charge will be made either to the available engineer or the organization or individual seeking engineering talent.

The number of opportunities for employment of which the A. I. E. E. and the joint Bureau have knowledge does not at present equal the number of engineers whose services are available, and as this disparity will be accelerated as demobilization of military forces progresses, the co-operation of industrial establishments and others needing the services of engineers is earnestly desired. The necessary qualifications for each position and the approximate salary should be stated in each case.

The Board of Directors of the A. I. E. E. has instructed Secretary Hutchinson to continue the Institute employment service substantially as rendered to the membership for many years past and has authorized him to co-ordinate this service with similar activities of other engineering societies.

The plan for co-ordination will not involve any limitation of the privilege previously given to Institute members to have, upon application to the secretary, brief announcements of their qualifications published under key numbers in the Institute *Proceedings*, but on the contrary, will result in the members' names being carried also on the joint Bureau's lists. Announcements of vacancies will also be published as formerly but in many instances vacancies will not be announced in this manner, as they will frequently be filled promptly from the list of available men on the files of the Institute and the joint Bureau.

Communication may be sent either to the headquarters of the Institute or to W. V. Brown, manager, Engineering Societies Employment Bureau, 29 West 39th street, New York City.

WESTERN ELECTRIC COMPANY IN MOTION PICTURES.

Company Gives Two Special Movie Performances to Its New York Employes—Unique Example of Educational Work.

Western Electric Co. employes saw themselves as a family in films on the evenings of Jan. 20 and 21 at the Lexington Theater in New York City. Publicity Manager P. L. Thomson managed the show and it was quite a success. It would have "gone over" in any

theater with any audience. With one of 2500 or over on each occasion, nearly all of whom belong to the "family," it went even better.

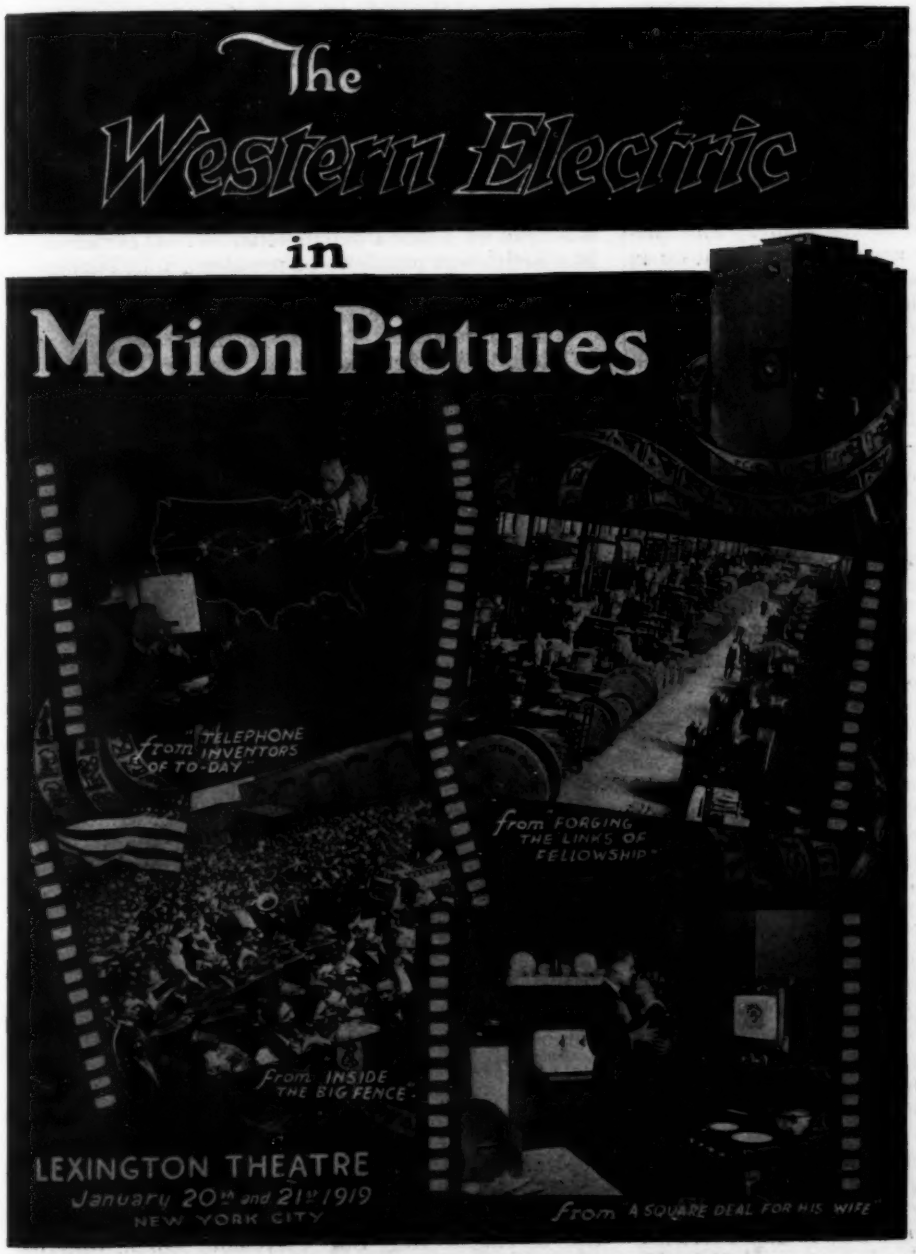
On the first evening, C. G. DuBois, vice-president of the company, presided, and on the second, F. B. Jewett, chief engineer. President H. B. Thayer was introduced upon each occasion and made some remarks, brief but to the point.

At one time, President Thayer said he knew everyone in the New York and Chicago offices. Thirty-seven years ago he started as a clerk, with Vice-President Albert L. Salt as office boy. Now there are over 200 acres of floor space in the offices, and to go around the buildings comprising the immense Hawthorne plant is a good day's walk.

Over 5000 young men went to the war from the Western Electric Co. But as Mr. DuBois emphasized, it was not in mere man power that the company contributed most. It was in furnishing special and unique contrivances to hasten the end of the war that it was of the most service. These are divided into three main classes: Adaptation of the wireless telephone to the airplane; submarine detectors; range-finding apparatus for the location of distant heavy guns through the agency of air disturbances created when they were fired.

Coming to the pictures themselves, these were not only excellent as to motion photography, but every foot of film carried a human interest thrill and punch which carried the audience open-eyed and open-mouthed, as is usual with audiences, where the picture is of the gripping type.

There were four films. First came "Telephone Inventions of Today" in three reels. It showed some of the things going on in telephone laboratories; engineers at work designing and developing and testing apparatus. Another phase was the actual commercial use of such equipment in the transmission of intelligence. For the first time there was made public the work of Western Electric engineers that was done for the Government. These latter pictures were filmed at Camp Vail, N. J., and shown by special permission of the War Department.



Cover of Program for Western Electric Motion-Picture Show.

The "family" saw just how a coin operates in a slot machine; they saw a "voice wave." The new selectors were shown, which are fast displacing the telegraph in railway signaling, and which permit the calling of only the particular tower man wanted. And there was the new telegraph printer that sends eight written messages over a single wire simultaneously, at the rate of 400 words a minute. And the amplifiers and the loading coils which make possible transcontinental telephony were also shown.

Lieut.-Col. Jewett's apparatus used so successfully in airplane wireless was thrillingly demonstrated and brought great applause. It works for a distance of 10 miles, from ground to plane or from plane to plane. The current for operating it is derived from a tiny generator on the plane, in turn operated by little propellor blades or windmills turned by the rush of air as the machine pursues its flight.

Also there was the most interesting and almost comic stunt of showing how the 205 parts of an ordinary desk telephone go together, all these parts

hopping into place with great celerity and in a manner quite grotesque.

"Forging the Links of Fellowship" was the second film, in two reels. It showed the great Hawthorne works in their entirety. In the film they appear collosal. There is a stronger impression created—almost of romance—than to see them on the spot. Many of the manufacturing processes were also shown, such as the making of lead-covered cable, the insulating and winding of wires, etc.

A high school boy calls at the Hawthorne plant in the third film—"Inside the Big Fence." He comes to look the place over and decide whether or not the Western Electric Co. has anything attractive to offer him in the way of a career. It ends by his signing up and entering upon what is virtually a college education. He sees that all must take a physical examination, the same as in entering the army. He is taken on a trip through the plant, sees the hospital and the restaurants, learns of the Hawthorne Club with its branches for tennis, trap shooting, baseball, camera work, etc. He sees the band and orchestra. The great laboratories are there—the schools of instruction where he may get his education. And the great shops so diversified in their activities that there is no line for which he is fitted that he may not follow.

In the last film—"A Square Deal for His Wife"—a little play is given which brings out another side of the business—marketing electrical household appliances to lighten the burdens of the home. This picture is now being shown as an educational feature in motion-picture theaters throughout the country and is proving to be a considerable factor in spreading the gospel of "Do It Electrically."

SEMI-ANNUAL MEETING OF THE ELECTRIC POWER CLUB.

Important Subjects Considered by Motor and Other Electrical Power Machinery Manufacturers at Cleveland Meeting.

One of the most successful of its many excellent meetings was the semi-annual meeting of the Electric Power Club held Jan. 13, 14 and 15, at the Hotel Statler, Cleveland, Ohio. A brief report of the first sessions was published in our last issue. For the following complete summary we are indebted to Secretary Roth.

During the war the regular routine work of the Club was laid aside and every energy put into work that would aid in winning the war. The regular technical committees had not had time since the signing of the armistice to meet and had done but little work by correspondence, therefore the first day was given over entirely to committee meetings and sessions of the Board of Governors. The committees spent a very busy day. In fact, some of them had so much work ahead of them that they began meeting on Saturday in order to get lined up ready for their reports on Wednesday and in order to get other work started.

The first general session was opened Tuesday morning with an address by President C. L. Collens, 2nd, followed by reports from other officers and standing committees. Several new members were added to the Club.

One of the main features of the morning was an address by Walter Robbins, vice-president of the Wagner Electric Manufacturing Co. Mr. Robbins did efficient service as chief of the Power and Electrical Equipment Section of the War Industries Board. He has been chosen by Secretary Redfield of the Department of Commerce as one of his special industrial advisers. Mr. Robbins spoke on "Industry's New Contact with Government," and outlined the opportunity that the electrical industry now has to get into close touch with the Government and to co-operate with it in settling some of the problems confronting the industry. He had no program laid out, but invited the Club to unite with the other branches of the electrical industry and bring their problems to the Department of Commerce.

Gilbert H. Montague, a New York attorney, also spoke on "Co-operation with Government." He spoke of the satisfactory work of the Federal Trade Commission. Out of the 200 proceedings before it, most have been settled by agreement, only a few of its orders have been contested and only one has been taken up to the Circuit Court of Appeals. He outlined a method by which trade associations can have trade abuses that have grown up settled amicably with the assistance of the Federal Trade Commission.

The afternoon session was taken up by a symposium on foreign trade. Gilbert H. Montague, who assisted in framing the Webb-Pomerene bill, outlined the different kinds of combinations which can be formed under that law and their methods of operation.

Trade Commissioner Philip S. Smith, of the Bureau of Foreign and Domestic Commerce, had prepared a paper on the South American situation, which was read by Trade Commissioner W. M. Strachan, as Mr. Smith was unable to be present. S. L. Nicholson, of the Westinghouse Electric & Manufacturing Co., read a report for the Tariff Committee.

The banquet on Tuesday evening was a general jollification and get-acquainted meeting followed by a paper on "Terms of Payment" by L. W. Lyons, credit man for the Westinghouse Electric & Manufacturing Co., and another on "Contract Forms" by Hugh A. Brown, sales manager for the Burke Electric Co.

The last day was taken up entirely by reports of technical committees and adoption of standards, except for two papers, one on "Uniform Motor Design," by James Burke, president of the Burke Electric Co., and another on "Standardization of Raw Materials," by A. H. Moore, of the General Electric Co.

The Club adopted 32 volts as a standard voltage for small motors to be used with farm lighting plants. Another adopted standard is "The dimensions from shaft center to bottom of feet shall not be greater than the nominal dimension shown on manufacturer's dimension sheet. Where the motor is to be mounted on other machinery and exact height of shaft is required, it is expected that shims will be used to secure alinement."

The Large Power Motor Committee is studying the subject of pulley sizes and belt speeds with the idea of adopting standard pulley sizes. The committee is conferring with other associations interested, particularly the Standardization Committee of the International Belting Conference, and will report at a later meeting. The Committee on Industrial Control presented a number of definitions, which were adopted.

The Transformer Committee presented a number of recommendations. Among those adopted was a table of standard ratings for three-phase distribution transformers, and a rule to cover insulation test voltages of the low-voltage side of transformers.

The Club has been very fortunate in having as president, C. L. Collens, 2nd, of the Reliance Electric & Engineering Co., Cleveland, Ohio, who has acted during the war as chairman of the Electrical

Apparatus War Service Committee; and also as a member of the General War Service Committee of the Electrical Industry. He has been untiring in his efforts, and the Club gave him a very hearty vote of thanks for his devotion to the work even to the neglect of his own business.

ELECTRICAL MANUFACTURERS PLAN TO CONTINUE BENEFICIAL CO-OPERATION.

Group Committees and Manufacturers' Council Hope to Further Standardization, Conservation and Uniform Accounting—General Convention Proposed.

The General War Service Committee of the Electrical Industry and the chairman of the group committees held a very important meeting in New York City recently to discuss continuing of the very effective co-operative organization of the electrical manufacturers and other branches of the industry which enabled them to meet the Government's needs so well during the war.

The meeting was presided over by C. L. Collens, 2nd, who explained the objects of the meeting as being first, to plan an organization for the transition period, by continuing the war service organization or otherwise; second, to define "electrical manufacturer" so as to determine eligibility to membership in the organization; and third, to plan a convention of all electrical manufacturers for the presentation of problems and afford them an opportunity to accept the invitation of the Department of Commerce to co-operate with it.

Before discussing these objects, Walter Robbins was introduced and spoke to the following effect: "When the War Industries Board started its work the first problem was to secure deliveries of equipment most needed. Little thought was given to the question of conservation. Later on the questions of priorities and conservation of materials became tied up with standardization and curtailments. As this work progressed, the various group committees had a talk with the Army Standardization Committee, and it was then proposed that when this work was completed conservation should not be promulgated until real standardization could be effected. It was looked upon as an opportunity to take advantage of the necessities of war to bring about improvements in the industry which would last after the war. Inasmuch as these changes would benefit the industry as well as the Government, they were considered by both sides with enthusiasm. Just before the armistice was signed, negotiations were on to bring Prof. Comfort A. Adams, a man of national standing, into this work. Mr. Shaw had pledged himself in this connection. It has been decided that much standardization work should go on. Secretary Redfield is interested in the work that has been done and feels the Department of Commerce has been isolated; he feels favorable to business in spite of the impression to the contrary that seems to prevail. Mr. Shaw suggested that the electrical industry was in good condition, well organized, and could proceed with speed, but he felt that no conservation schedule could be promulgated without authority and a request from the industry in that regard. No request having come, schedules were not promulgated.

"At the Atlantic City convention Secretary Redfield invited 14 members of the War Industries Board, including myself, to represent your industry, to act as his advisers. We can now get in touch with the Department of Commerce and possibly through that department bring about certain things of lasting benefit to the industry." In a talk with Mr. Shaw, Secretary Redfield asked why this standardization work could not be carried forward by the Bureau of Standards and it was explained that this Bureau is a technical one and the industry needs commercial rather than technical standardization. There are now some 38 different bodies trying to regulate the electrical industry with no agency to bring these bodies together.

"The electrical industry was suggested for a trial of this (Government-Industry) co-operation, because it was in such good shape and this meeting is called to try and take advantage of this invitation. As an example of what we can do, we can devise a uniform cost system for each branch of the industry which, through the Department of Commerce, the United States Treasury might accept as a means to adjusting differences between private and Government auditors in making examinations for taxes.

"I am here today representing the Department of Commerce and it is not my purpose to sell an idea to you. It is your opportunity and such advantage will be taken of it as you direct. Some 15 months ago when I went to Washington I pledged myself not to advocate anything on confidential information received from the industry without the approval of the War Service Committee. That policy was followed and will be the policy still. I will suggest to Secretary Redfield only what you direct and I will only advocate such things as you indicate. Nothing has been outlined in the letters between Secretary Redfield and myself. He wants something definite from us. I have reported progress to the Secretary and stated that the industry is trying to organize for carrying on the work."

Mr. Collens then said: "As you know, the General War Service Committee was appointed by the Electric Power Club, the Associated Manufacturers of Electrical Supplies and the Electrical Manufacturers' Club. At first the divisions already organized were recognized, but as the work progressed there were added groups not represented in any of the existing associations, such as Electro-Medical, Storage Battery, Electric Furnace, Signal and Communication, Dry Battery, etc., so that now we have an organization with some members who had no contact before the war. One of our problems is how to maintain the co-operative relation, which has developed, in branches of the industry not previously organized, without detracting from existing associations. It is very undesirable to duplicate organization. Throughout the war no duplication of work resulted, and now in the conservation and standardization work, cost accounting, etc., it would be unfortunate to duplicate work now being done by the old associations. So it is proposed to continue existing organizations and develop the independent groups to continue the co-operative work done during the war, either as independent organizations or absorb them into the old ones.

"What central executive body shall co-ordinate these different sections or groups? The General War Service Committee has felt itself of a temporary character ready to disband in due course and let the industry itself determine its future. Yesterday a meeting was held with the Electrical Manufacturers' Council, which prior to the war was a medium of contact with the Government, to give the matter careful attention and the recommendations evolved will be presented after we give you an opportunity to hear from different members of the General Committee and Mr. Nicholson."

Mr. Nicholson said: "The Council was formed some years ago to act as an intermediary between the various associations and to co-ordinate their work. There are purely association matters which do not affect other associations in the industry and other matters which affect the entire industry. The Council at first was purely an advisory body and did not originate. Some things handled in the past were: (1) standard cost-accounting system, which had the approval of the Federal Trade Commission. The Council today has a standard committee on cost accounting; (2) the Code situation, which is rather complex; (3) standardization of literature.

"The Council at the present time is the mouthpiece of the electrical industry and prepared to work with such national associations as the N. E. L. A., A. I. E. E., etc. Standardization and conservation are matters largely for individual groups to handle. For example, standardization of motors is a problem of the Electric Power Club; the Council only handles matters of interest to the entire industry. It is of extreme importance that we go on with a certain work started during the war and that as an industry we have contact with the Government to lay our problems before it. It is of utmost importance to the industry as a whole that groups not affiliated with any of the existing bodies should either form an organization of their own or become affiliated with one now in existence because of the many advantages to be gained thereby.

"One question to come up is tariff. Probably each association will report its needs so that the Council can submit the matter through the proper channels to the Government. As now constituted, the Council can take in other organizations, provided they are electrical, and as we have a definite organization in the industry we should do our work through it rather than to start up a new one which would only be a duplication of effort."

Mr. Hobart addressed the meeting at length from another angle and expressed the opinion that there was danger of emphasizing too greatly the difficulties of the situation. He referred to the statement made by President Wilson at Manchester on the balance of power to the effect that "those leaders who do not recognize a world-wide demand for greater freedom of self-expression on the part of the individual fail to realize the meaning of the victory that had been won." Mr. Hobart called attention to the fact that some of our leaders of industry, like Messrs. Schwab, Rockefeller, and others, have already given such recognition, and he pleaded for the election of a general executive committee by the industry as a whole so that no doubt can be cast upon the statements which it may be called upon to make before a legislative body. If there be members who do not vote they could not then secure support to their statement that they had not been consulted. The great objective is to secure the same co-operation that we had during the war. All the co-operation that then existed cannot continue under present laws. Therefore we must get the laws changed, but what chance has the industry when it represents only 1 to 50 in the voting? The proposed method of co-operation with the Department of Commerce is only a starter, we shall want co-operation with the Department of Labor before long. "If we organize 'democratically' we shall mold public opinion and get the same recognition as organized labor." Unless the public believes there is a high ideal behind what we are doing we are going to suffer trials we could otherwise avoid.

Messrs. Nichols and Terry heartily endorsed the program set forth and hoped that the good work would continue.

The following resolution adopted at the joint meeting of the General War Service Committee and the Council was then endorsed:

Whereas, the General War Service Committee has completed the task for which it was appointed and made its final report to the Electrical Manufacturers' Council, now, therefore, be it

Resolved, that the Electrical Manufacturers' Council recommend to the Electrical Manufacturers Club, the Associated Manufacturers of Electrical Supplies and the Electric Power Club that the resignation of the General War Service Committee as tendered be accepted; and further

Resolved, that the Electrical Manufacturers' Council and the General War Service Committee in joint meeting recommend to the chairmen of the various War Service Group Committees that they continue the present group organization, such groups as at present form divisions of existing organizations reporting and acting through and with those organizations; such groups as are not at present members of any organization to join with an existing organization or to perfect one of their own as they may elect. Co-ordination of all to be effected by representation on the Electrical Manufacturers' Council, through which body the proper contact with Governmental departments is to be effected. And further recommend that no contact between individual divisions or groups and Governmental departments or other associations be effected without reference first to the Electrical Manufacturers' Council.

It appeared that many groups not affiliated with associations expect to join the one to which they are eligible. A method of raising funds for carrying on the work was discussed. Independent groups should determine some plan in this regard. If they co-ordinate with the Council they would come under the provision for assessment to cover the expenses of the Council. Decision as to what manufacturers should be embraced in the Electrical Manufacturing Industry was referred to the Council.

There were discussed plans for a joint meeting of the associations and independent groups of the industry at which efforts will be made to prove to individual manufacturers the need of this co-operative effort even though the war is over. Vigorous effort on the part of each individual chairman will be necessary to make this meeting a success. The arrangements for this meeting were left with the Council.

FURTHER DETAILS OF INTERNATIONAL GENERAL ELECTRIC.

New Corporation Has $20,000,000 Capital—Strong Board of Directors—Gerard Swope Is President.

Brief mention was made in our issue of Jan. 11 of the formation of the International General Electric Co., Inc., this being a new corporation to handle the export business of the General Electric Co. Further details of the new organization have now been announced. Articles of incorporation were filed with the Secretary of State of New York at Albany on Jan. 17. The capital stock is $20,000,000, of which one-half is 7% cumulative preferred stock and one-half common stock. The directors of the company are Gordon Abbott, A. W. Burchard, C. A. Coffin, George P. Gardner, J. R. Lovejoy, S. Z. Mitchell, G. F. Morrison, Charles Neave, E. W. Rice, Jr., Gerard Swope and O. D. Young. Charles Neave, of Fish, Richardson & Neave, attorneys, New York City, is chairman of the Board of Directors. Gerard Swope, formerly vice-president of Western Electric Co., Inc., has been elected president of the new corporation, and M. A. Oudin has been chosen vice-president.

Commercial

Welcoming Our Boys Home-coming Electrically—Electric Bakery—Coming Business Prosperity—Appliance Activity

NATION-WIDE MOVEMENT TO BRIGHTEN UP FOR RETURNING SOLDIERS.

Society for Electrical Development and Other Organizations Co-operate for Electrifying Welcome.

Reports indicate that the welcome-home spirit toward returning soldiers is being manifested electrically everywhere, and that many of the signs and devices which are being employed are of a character to insure their permanency for a long time to come. On the front of the Rivoli Theater in New York City, for instance, there is a cluster of myriad lamps so grouped as to flash out the Allied emblems in all their glorious colors, atop of which is the American eagle guarding a shield. On the Union League Club there is a great electric sign which blazes forth this message: "Welcome Home to the Boys from Over There." In fact, look where you will, electricity is on the job of welcoming the boys back to "God's Country."

Some idea of the magnitude to which the plan of welcoming the boys home electrically is being carried can be had from these facts regarding the equipment that is being installed for the New York Times Building, and which consists of over 5000 10-watt lamps distributed as follows: The entire building will be outlined with 300 2-ft. stars, each star containing 11 lamps, alternating red, white and blue on a flasher. On the 43d Street side, facing Times Square, will be a cluster of allied flags, surmounted by a spread eagle holding the American shield. This display utilizes 1000 lamps and will measure 40 ft. wide by 24 ft. high. The flags will have a waving effect, and over this will be an electric sign reading "VICTORY," in 6-ft. letters. At each of the four entrances of the building will be a pair of crossed American flags waving; these will contain 250 lights each. And on the roof will be four flashlights illuminating the American flag flying from the flagstaff.

However, expression of the welcome-home spirit is not restricted to those only who can go in for large and elaborate displays. Individual dealers, many of whom have neither the facilities nor the means to make a big display, have utilized their windows as the basis for their share in the generally expressed welcome. In some of the windows, army and navy signal flags are grouped to spell out appropriate messages of welcome, the whole being lighted by flashers or flood lights. In others, small lamps, operated by flashers, are grouped to spell out such messages as "Welcome Home," "And You Did Come Back and With Victory," "Welcome to The Victors," "Welcome Home, Boys." In others, flags and painted messages are rendered attractive by the judicious use of light.

Other states and cities, too, have taken up the question and are formulating definite plans for welcoming their returning citizen-soldiers. In Chicago, for instance, the Commonwealth Edison Co. has taken an active part in the movement to arouse and direct the enthusiasm of business interests, as well as to secure the co-operation of clubs, churches, civic and other bodies. Recommendations to cheer up, paint up, brighten up and light up were scattered broadcast. A series of newspaper advertisements were run in the six leading Chicago papers, being continued over a period of six weeks. "Let us," said a newspaper editorial, "show our boys that Chicago welcomes them back home just as heartily as it enthused when they marched away. The Chicago slogan is 'I Will'—well, let's put the I WILL spirit back of our welcome." Chicago is doing just that.

The Society for Electrical Development called a meeting of a special committee, which was held December 17th, in New York City, to formulate ways and means to enable the Electrical Industry to do its share towards making the boys realize that America honored them for their patriotism and was not forgetful of their many sacrifices. Copies of the advertisements used by the Commonwealth Edison Co. of Chicago have been sent to all the central stations in the country, together with a letter outlining how they can best get behind the welcome-home movement. Dealers, contractors and manufacturers, too, have been advised of the parts they can best take in making the movement successful. And all business interests that can contribute to the brighten-up phases of the movement have been or are being notified of the responsibility resting upon them to participate.

The idea is to cheer up and pass the good feeling along to others, accomplishing that purpose by painting up, fitting up, cleaning up and lighting up. It was natural that the movement should have had its inception in the coast cities where troops are disembarked, but it is spreading now to the inland cities and towns and that, too, is natural. Americanism and enthusiasm for the feats performed by our boys under arms is in no sense sectional; every town and hamlet in the entire country desires to join in the welcome to our returning troops and all should be encouraged and assisted to do so. The press of the country can and should get behind the movement. The boys have earned the right to expect that the "old home town" will not go unmindful to bed, leaving them to come home in the dark, so to speak, and uneasy should be the sleep of any who are so selfish and thoughtless.

ELECTRIC BAKERY TURNS OUT 5000 LOAVES DAILY.

Energy Consumption of Boston Bakery Varies Between 30,000-40,000 Kilowatt-hours Monthly.

About five thousand loaves of bread are being turned out each day in the electric bake ovens at the Receiving Ship, Commonwealth Pier, Boston. Since the summer the kilowatt-hour consumption on the electric cooking equipment has been running between 30,000 and 40,000 kw-h. each month.

NINE REASONS WHY BUSINESS SHOULD PROSPER THIS YEAR.

Reaction from War Conditions Indicates Great Possibilities for the Industry.

The following list of existing conditions recently appeared in the *Bulletin* of the United Gas & Electric Engineering Corporation of New York City, as proof of the contention that this is going to be a great year for American industry and especially the electrical industry. That these conditions will produce better business and bigger sales in electrical apparatus and equipment—more activity and increased consumption by existing customers and also many new customers is apparent and substantiates the general feeling that prevails throughout the country.

1.—The tremendous volume of ship building must continue. For if England, France and the United States go right on and produce ships to the absolute capacity, it will take six months before the loss in tonnage which Hun piracy has caused can be replaced. And then we want more ships for the re-birth of our foreign trade. There will be a tremendous business continuing to supply the shipping industries.

2.—Europe is worn out industrially and has got to be restored. The railroads in Great Britain and France have been driven till everything they own is old and needs replacing. Thousands of miles of rails have been picked up from commercial right of ways and taken to the front and then lost in the German drives or destroyed. Thousands upon thousands of locomotives and cars have been wrecked, worn out or demolished by shell fire. The machinery in all the factories of Europe has been driven to death and needs replacing. Here is a gigantic bulk of orders coming to America.

3.—Devastated France and Belgium must be rebuilt and later, all the war-torn eastern lands. Where will all the materials and fittings and equipment come from? The greater part of it will come from the United States of America. That will mean steady shipments month by month for several years from thousands of factories.

4.—In South America, in Africa, the Far East, everywhere, there is great need for manufactured articles of every kind. During the war England, France, Germany and Austria set all their factories to war work. They quit selling the world in the enormous volume of former years. There were no ships available anyway for carrying their goods to foreign ports. The trade stopped. The world has had to wait with a growing need, and now they will flood America with their appeals for merchandise. England and France will take a little time to restore their full export tonnage. Germany and Austria will be a long time getting back into the game. There is this brand new export business to be added to our sales.

5.—Then things are worn out here, too, and must be restored. War restrictions have made it almost impossible to get new machinery for all but active war use. What has worn out has been repaired as well as possible and teased along. Now, it will be replaced. Industrial plants will be restored to full efficiency and it will all mean large increase in business to the country to restore itself.

6.—And what of stocks in every city? Every manufacturer's reserve stock is down to nothing. Jobbers are fighting their way along with a little of this and a little of that and a long wait for the rest. Dealers' shelves in every town are almost bare. They are hungry for the goods that will permit them to do business on the old scale. Their orders will come crying in and it will take the factories long months to grind out just enough to bring stocks back to pre-war normal.

7.—Because the dealer hasn't had the goods, the consumer has been waiting, too. He has tinkered and patched up where he used to buy new. He has waited and deprived himself because there was a war on. Now that peace has come he will sail out and buy what he has been wanting, with a flood of retail business that will break all records in our history. He will buy freely because he has the money and is ready to spend.

8.—Another thing—for four years the price of building materials has climbed and climbed until general construction slowed down and quit. For two years the Government, to conserve materials and labor for the war construction, has prohibited building. People who have wanted to put up new houses, stores, offices or factories for non-war use, have had to wait. Now the ban is lifted and they will gradually go to it. First, the rich man will begin to build because he doesn't mind the cost, and business structures will go up because they cannot wait. Then, steadily, general building will resume and bring a very large volume of business to almost all industries, for there will be more of it for many years than normally established in the pre-war period.

9.—Then in every state organized work is being done to provide employment for returning soldiers and take up the possible excess of labor by beginning all kinds of public works, road building, reclamation projects. Civic, state and Government activities of every kind will be resumed and pushed because for several years these plans have been held up and there is pressure on all sides. It will bring still further orders to our factories, still greater demands for our labor.

NEW BUSINESS ACTIVELY DEVELOPED IN MINNEAPOLIS.

No Lull in January in Appliance Sales, House Wiring and Other New Business.

Despite the customary and anticipated falling off in electric appliance and house-wiring business during the first few weeks of January, the contrary has been in order in Minneapolis, Minn., this year. Sales Manager Young of the Minneapolis General Electric Co., reports on this matter as follows:

"More than a thousand dollars worth of appliances have been sold in our own appliance department during the past seven days. The public seems to be buying the more expensive appliances, many refusing to even look at the lower-priced devices. Our house-wiring department has also been unusually busy."

During the week ended Jan. 10 the Sales Department of the company secured 198 new electric light and power customers with 117 kw. of lighting and 367 hp. in motors. This includes 188 horsepower additional for the Air Reduction Co. and 71 hp. for R. R. Howell Co. as well as a new installation of 50 hp. for the American Harvester Co. New business connected to the company's lines shows an increase of 51 customers with 294 kw. of lighting. The electrical energy output was 19.4% greater than for the corresponding week last year.

Operating

Tranmission Line Nomenclature—Measuring Instrument Facts—Blasting Ice Jams—Underground Cable Splices

NOMENCLATURE FOR HIGH-VOLTAGE TRANSMISSION NETWORK.

Method in Vogue by Commonwealth Edison Company Includes Identification by Voltage, Frequency and Station.

Any scheme of identifying and specifying transmission lines and circuits should be such that the possibility of mistakes occurring due to misunderstanding should be avoided as much as possible. The method should be as simple as possible, easily remembered and applied. The more extensive a transmission network, the more complicated becomes the matter of identifying or specifying lines.

When there are a number of different generating stations, several different voltages and more than one frequency involved, the problem becomes even more complicated. And to simplify matters it is desirable that circuit or line nomenclature should be foolproof, thus embracing in its method of identification the voltage and frequency of the line, and preferably the generating station from which it emanates.

The accompanying table shows the way in which the Commonwealth Edison Co. identifies its high-voltage transmission lines.

TRANSMISSION LINE NOMENCLATURE, COMMONWEALTH EDISON CO.

		Station		
		1	2	4
Cycles.	Voltage	Fisk.	Quarry.	Northwest.
25.....	9,000.....	84-199	201-299	401-499
60.....	12,000.....	1101-1199	1201-1299	1401-1499
25.....	20,000.....	2101-2199		
60.....	22,000.....			

The three main generating stations, Fisk, Quarry and Northwest, are numbered, respectively, 1, 2 and 4. The voltages employed are, respectively, 9000, 12,000 and 20,000 volts, and the frequencies 25 and 60 cycles. For a line to be completely identified its number must tell the station from which it obtains its supply, its voltage and periodicity, if not determined by local conditions.

For example, Line No. 1201 indicates that (1) the voltage is 12,000, that the line is connected to station 2 (2), which is Quarry Street, that it is No. 1 line in this station. No. 1 12,000-volt line from Northwest Station (Station No. 4) is 1401, the first numeral indicating the voltage, the second the station number, and the remainder the actual number of the line. Were there any 25-cycle, 20,000-volt lines from Station 4, which there are not, their numbers would commence 24.., indicating that the line is for 20,000-volt service and is supplied from Station No. 4, which is the Northwest station.

This nomenclature is very similar to that of the Portland Railway, Light & Power Co., of Portland, Ore., described in the April 6, 1918, issue of the ELECTRICAL REVIEW.

CONSIDERATIONS INVOLVING CHOICE OF MEASURING INSTRUMENTS.

Accuracy, Purpose, Maintenance Are Some of the Considerations Involved.

BY M. SEYMOUR.

In adopting electrical measuring instruments for switchboard or portable use the conditions involved are somewhat different for the industrial and manufacturing plant to what they are for the central-station company. Cost is a factor in both cases, but in the case of shipbuilding yards, mines and similar industrial concerns other factors become of importance.

A dead-beat instrument necessitates a small air-gap, if a high degree of accuracy is to be obtained. A small air-gap is more susceptible to the effect of dirt and dust and foreign particles than is a meter with a larger air-gap. The instrument with the smaller air-gap is more prone to have the movement of its moving element interfered with, therefore, than is the instrument with the larger air-gap. The meter with the smaller air-gap requires more frequent overhauling and cleaning if accuracy is to be maintained and sluggishness prevented.

It is well for those connected with steel mills, cement mills, mines and similar industrial plants where there is dust and dirt in the air, to bear in mind that much annoyance and many mistakes will be prevented by employing a rugged type of meter with comparatively large air-gap, will usually give better all-round results and require less frequent cleaning and overhauling than one with a higher degree of dead-beatness, a characteristic that is not in most cases at all necessary for these classes of installations.

The scales of indicating electrical instruments usually consist of black figures upon a white background. Often the lamp over the switchboard casts its rays upon the shiny white scale of the instrument, the effect being intensified by glare from the glass, obliterating the thin black markings and tending to cause errors in reading the instrument.

Better than the black marking upon a white background are the white markings upon a background of black. The markings stand out in greater contrast and are more easily seen in both daylight and artificial light. The instruments can be read from a greater distance with greater accuracy. Less illumination is required to make the scales of instruments visible.

BREAKING UP ICE JAMS WITH POWDER.

When the ice starts its annual breaking-up, the cakes float down stream to the deeper water beyond and into the open sea; that is, those cakes whose progress is not stopped by rapids, a bend in the course, or a bridge pier. When one cake is held fast by some such obstruction, other cakes jam against it or pile on top of it, thus forming the gorge. If piled against a

bridge pier, the tremendous pressure is often sufficient to wreck the structure. If the obstruction does not give way, the dam formed by the gorge causes the water to back up and flood the surrounding country with the result above described.

Such occurrences are numerous and a review of the situation discloses that these ice gorges form at about the same place each year.

The most practical way is to blast the ice either before the gorge forms or to blast the gorge itself. A low-freezing explosive should be used as it seldom needs to be thawed before using.

Blasting the ice when it starts to break up leaves it in pieces small enough to float over ordinary obstructions and pass safely on. If the gorge has already formed, large quantities of explosives must be used and applied at the weakest point in the ice formation. Many hydroelectric plants encounter the same trouble each year, and in the same place. It is usually easier and safer to keep the ice broken up than to wait until conditions become so serious as to threaten structures or interfere with the flow of water.

One of the largest ice gorges is formed in the Niagara River each year. To blast this gorge about 2100 lb. of dynamite are fired in one charge. The work is done usually in the middle of the stream where there is slight danger of damage to lives and property on shore.

The services of an experienced blaster are desirable but not essential. Any level-headed adult can blast ice. The manufacturers of explosives will always render assistance in time of danger, if asked.

REDUCING TROUBLE AT UNDERGROUND CABLE SPLICES.

Improved Methods of Making Splices and Better Working Conditions Lessen Faults at Cable Splices.

By Howard M. Alsop.

Those that are familiar with the maintenance of high-voltage underground cables appreciate the fact that certain sections of cable are more prone to failure than others, a fact usually explainable in that the ambient earth is of lower heat conductivity—that is, is of greater heat insulating property than the remainder of the soil surrounding the remaining length of the line—causing high temperatures and eventually dielectric failures.

Another fact worth mentioning is that cable splices often are the seat of trouble, showing that although special effort is made to make a satisfactory splice, the result is not always successful. Still further, it will sometimes be found, on looking up the records of cable troubles, that the cable break-downs at the splices attain a higher percentage of the annual failures during the summer months than during the winter months. This is a rather surprising fact, since one would ordinarily suppose that a splice would be better executed in the summer than in the winter because of the better weather conditions—lack of rain and snow, longer periods of daylight, etc.

While every effort is usually made to make any operation as mechanical as possible, often eliminating the human element entirely, in cable splicing, the operation is almost wholly dependent upon the human element. It is this fact, the writer believes, that explains why cable splices cause more trouble in the summer months than in the winter months, or, at any rate, why splices made during the summer cause more trouble than those made in the winter months.

Man is sensitive to cold, heat, intense dryness or extreme humidity. Distracting influences, odors, excitement and nervous conditions affect his work. At the best of times a manhole is not the most favorable place for doing any sort of work; nor are the best possible facilities usually available. A cable splice requires careful and capable handwork, which means also calm, concentrated headwork. The man's mind must be on the job 100%, and hand and head must work simultaneously. When these conditions do not obtain, a splice that will eventually cause trouble and cable failure may be expected.

Among the factors tending to result in well-made splices are personal comfort—ample ventilation in the manhole, absence of intense heat or extreme cold, absence of water, noxious and dangerous odors and fumes from gas mains, sewers, etc., and lack of concern that vehicle traffic will become endangered or endanger the workers in the manhole. In other words, the more favorable the working conditions under which a cable splicer labors the greater the probability that a good splice will be made.

In the summer months the increase of cable failures usually results in overtime for the cable splicers, creating physical and mental fatigue and hurried work. These favor poor work. Manholes are hot and uncomfortable and hurried work makes matters worse. A cable splicer that is perspiring may be expected to make a splice that will fail.

Cable splicing is largely a manual process, thus depending upon the erratic human element. The fewer the operations involved the less the opportunity for poor workmanship to enter into the splice. And the less these operations are performed by hand instead of by machine the better for the longevity of the splice. Much will be accomplished in the way of making cable splices better by giving more attention to making manholes fit to work in, and reducing the actual handwork on the splice by adopting mechanical methods. Both of these remedies—palliatives is perhaps a better word—devolve upon the company instead upon the men. In other words, if a company furnishes the best tools, methods and facilities, the cable splicers will be less handicapped and do better work.

METHOD OF DETERMINING APPROXIMATE BOILER EFFICIENCY.

Ordinarily boiler efficiency is determined by analyzing the coal, determining the heat input to the boiler and the heat absorbed. This necessitates a knowledge of the thermal units in the coal, the amount of coal used, water evaporated, etc. Determining these factors takes time and experience and necessitates the use of apparatus often not available.

An approximate short-cut method of determining the approximate efficiency of a boiler without weighing the water or steam, or knowing the analysis of the coal or quantity burned is as follows: All that is necessary for making this approximation is an Orsat or CO_2 recorder, a thermometer or pyrometer in the stack for indicating stack temperature or temperature of the flue gases, and the temperature of the air entering the fuel bed. Then,

$$\left(0.35\times\frac{T_1-T_2}{CO_2}\right)+R=\%\text{ loss.}$$

Where T_1=Temperature of gases leaving boiler.
T_2=Temperature of air in boiler house.
CO_2=Percentage of CO_2 in gases (at point T_1) as determined by Orsat set or CO_2 recorder.
R=Radiation and other losses taken at 5%.

Contracting-Construction

Third Croft Article on Pulling in Wires—New Problem Which Confronts Contractors—Methods of Testing Fuses

ATTACHING CONDUCTORS TO FISHING WIRES AND PULLING-IN LINES.

Method of Coupling Heavy and Groups of Small Wires to Fishing Tape and Rope Pulling-in Lines.

By Terrell Croft.

[This is the last of three articles that discuss the different methods of connecting the fishing or pulling-in means to the wires to be pulled into a conduit system. These articles are practically a continuation of the series of seven articles on fishing conduit by this well known author that were published in the Electrical Review *of Aug. 24 to Oct. 5, 1918. The increasing importance of conduit work and the dearth of information available on this subject should make these articles of interest to contractors and electricians.]*

In Attaching Heavy Cable Conductors to Pulling-in Lines the arrangement portrayed in Figs. 11 and 12 may be adopted. Fig. 11 depicts the appearance of two heavy cable conductors made fast to a pulling-in line by the method to be described; the attachment is

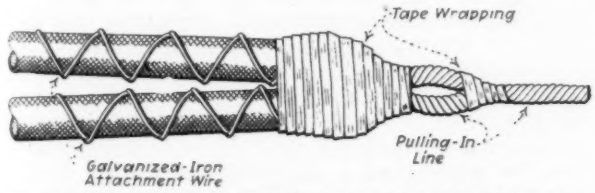


Fig. 11.—Two Heavy Conductors Attached to Pulling-in Line.

shown as completed with its tape serving and is ready to be drawn into the conduit. In making up this kind of an attachment a piece of No. 10 iron wire (Fig. 12) about 4 ft. long is looped around the end of the cable once as shown at *I*. Then the two free ends of this iron wire are wrapped around the cable, in opposite directions, so that about 3 or 4 in. of free wire is available at the ends for attaching to the loop in the pulling-in rope. The wires completely made up are

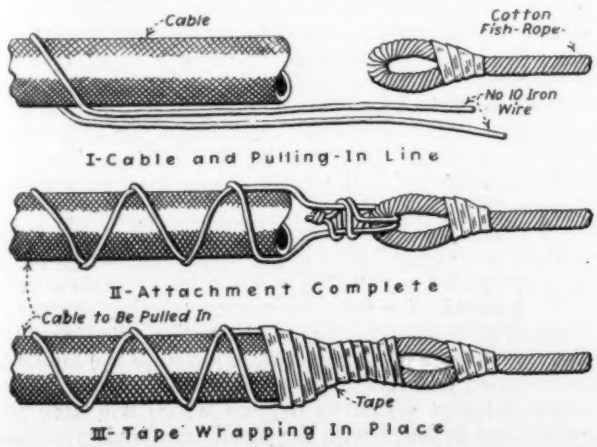


Fig. 12.—Three Steps in the Attachment of a Heavy Conductor to a Pulling-in Line.

shown at *II*. Finally, a tape wrapping is served over the attachment to prevent fouling. It is false economy to be stingy with the tape. It protects the end of the cable, strengthens the connection, and keeps the free ends, which might otherwise catch on obstructions inside of the duct, on the inside where they belong. Note that as tensile stress is impressed upon the connection of Figs. 11 and 12, the galvanized-iron wire "bites" into the insulation on the cable. The greater

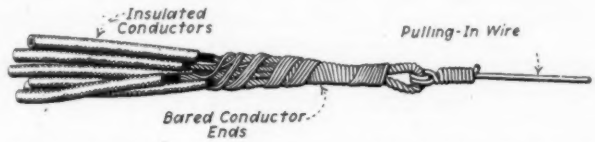


Fig. 13.—A Group of Single Conductors Attached to a Pulling-in Wire.

the pulling force, the deeper the iron wires woven around the cable will bite into it. For these reasons an attachment of this type is very economical and effective.

Cable grips employing this principle are now available on the market. The gripping portion is generally laced and can be readily stripped over the cable or large wire to be drawn in.

In Attaching a "Bunch" of Small Conductors to a Pulling-in line the ends of all of them are first bared. Then a number of these bared ends are twisted into a cable (Fig. 13), which is made up into a loop in the end of the pulling-in line. Now the bared ends of the remaining conductors are so made up about the little cable thus formed that there results "conical wedge"

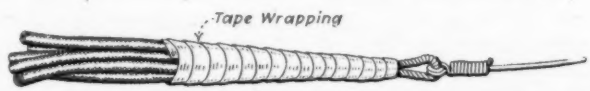


Fig. 14.—Attachment Taped Over and Ready for Pulling In.

form, referred to previously. Finally, the attachment is served with tape (Fig. 14) so that it will offer minimum resistance inside of the conduit.

In Arranging the Conductors of a Cable on a Pulling-in Line in an Identifying Sequence they can be fastened in a certain order on the line (Fig. 15). This method is useful where multiple-conductor cables for signaling or for other purposes are to be pulled into conduit. Its use obviates the necessity of testing out and tagging after installation. As the cable which is to be drawn in is being made up, the two ends of each of its component conductors are bared for about 4 in. One end of the first conductor is made up around the pulling-in line (Fig. 15) and the other end is tagged "No. 1" or is wrapped around a short dead length of wire which will be called the "dummy" wire. Then one end of No. 2 conductor of the cable is wrapped around the pulling-in wire in sequence in position No. 2. Its other end is tagged "No. 2" or

is wrapped in No. 2 position around the dummy wire. No. 3 and succeeding wires are handled in a similar manner. Hence, upon the completion of the cable

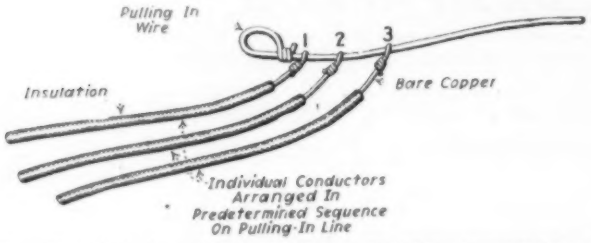


Fig. 15.—Conductors Which Are to Be Pulled In Arranged in a Predetermined Sequence on the Pulling-in Line for Indentification.

all of its conductors are identified by the sequence in which they were arranged on the pulling-in wire. Now, the cable can be pulled in. It can be connected properly without further testing because the order of the component conductors on the pulling-in wire identifies each. This scheme saves considerable time.

INSTALLING WIRING WHICH WILL NOT BE USED IMMEDIATELY.

By S. M. Hall.

One of the problems which electrical contractors will undoubtedly come into contact with during the next year will be in wiring new buildings which at the time of construction are not in a location where electric service is available or where on account of the building not being immediately occupied the wiring will not be used for some time. The question of how far to complete the wiring of such buildings is a difficult one and one which has too often discouraged contractors from attempting to secure such work. It arises from the difficulty of keeping such unused wiring in a proper condition so that when the time comes that it will be used, no difficulty will be encountered.

Where the building is to be occupied soon after completion and the prospects are such that electric service will be available in a short time this question is comparatively simple. In such cases the contractor can feel reasonably safe in installing the wiring complete, confident that no trouble will develop before it is to be used. Unfortunately, such conditions do not always prevail and when the time comes to use the wiring the owner finds the wiring in such a condition that quite extensive repairs are necessary before it can be used. This trouble is brought about by the excessive depreciation and damage to which any apparatus not in use is subjected and the fact that switches, fittings, etc., are often stolen or destroyed. The effect of such conditions on property owners who believed their wiring to be in good condition, ready for service whenever desired or available is very bad and often gives them a poor impression of the contractor and the entire electrical field. For this reason reliable contractors have often neglected this work feeling that the possibilities of such troubles occurring would injure their reputation.

This condition, of course, should not exist as there are many reasons why the wiring of a building should be installed at the time of construction. Primarily it is cheaper to wire a building, whether the work is open or in conduit, when it is being erected and also the finished job is better. Furthermore, it is much easier for the contractor to induce an owner to have the building wired at such times. This is especially true when the buildings are constructed by building contractors or others and are to be sold when completed. In such cases the electrical contractor is very often able to secure the contract for an entire group of buildings at once whereas, if the opportunity is neglected each installation must be secured separately.

To complete the wiring of such buildings, however, involves a risk which should if possible be avoided. The easiest method of accomplishing this is to only install that portion of the wiring which can be done more simply when the building is being constructed and which is not liable to theft or undue depreciation. This usually consists of the conduit, wires, outlet boxes, switch cabinets and boxes, etc., where conduit work is done, or the outlet plates, the wires properly installed on the knobs, etc., when open work is desired. This equipment should be left closed or sealed to prevent tampering and a diagram of the work done should be drawn and filed by the electrical contractor along with any other particular features of the building.

There is another difficulty encountered in this respect which can and should be remedied by the electrical contractor, that is, the providing of suitable information for the prospective customer as to the condition of the wiring as it is installed. The effect on the customer who finds that his wiring has never been completed, even although it was purposely left incomplete and was not paid for, is even worse than if it had been completed and some parts stolen.

There are several methods of combating this difficulty. A follow-up system may be instituted by the contractor to keep in touch with such installations and to secure the contracts for the balance of the work when it is to be done. Another method is to place a placard in a prominent place in the building, stating that the wiring is not completed but can be finished for a nominal sum by applying to the contractor. A combination of both these systems is also very effective.

Another difficulty frequently arises where the wiring is installed in cities having municipal or state inspection. The rules of these inspection departments usually require that the wiring be inspected during the course of the work in order that the inspector can make a proper inspection without disturbing the floors, walls and other parts of the building. As many such codes do not provide for the approval of a partially completed installation the result has been that a large part of this work has been carried on without any attempt being made to secure the necessary certificates. As a large number of these codes are being revised at present it is to be hoped that suitable provisions will be made in them for such approvals, for the opportunity which exists for contractors for this work will be especially great during the next year or two and such difficulties if remedied now may be avoided during this time.

Furthermore, as many contractors have been obliged to assume heavy losses in the past when parts of a completed installation were stolen or broken, it is very desirable for them or the contracting organizations to develop some means of meeting this difficulty. The practise of not completing a job until the building is occupied and ready for service is not always applicable unless a system is devised which will keep the contractor in touch with the installation and even then the extent to which it should be applied will depend

largely upon the individual installation. This may appear to be a minor matter to many contractors but those who have kept any account of the material, etc., which they have lost in the course of a year will appreciate the savings which can be made by giving this matter a sufficient amount of consideration.

NEW ELECTRIC CODE BEING PREPARED FOR DAVENPORT.

Outside Service Switch One of the Provisions of the New Code.

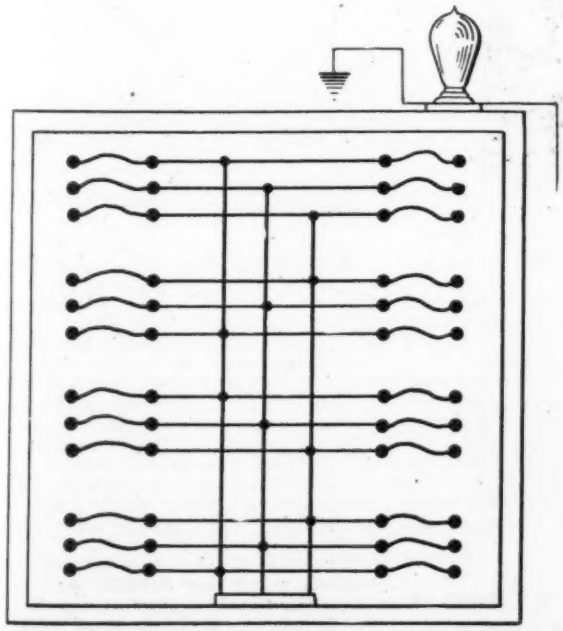
A new city electric code, which provides the manner in which all electric wiring must be done in the city of Davenport, Iowa, is being prepared by Frank P. Sammons, electrical inspector of that city, and will be submitted to the city council in the near future. The new code will be more modern in many respects than the present one and will contain several changes and additions.

One of the provisions of the new code will be that all buildings located in the central business district of Davenport must be provided with an outside switch which will cut off all the wiring and apparatus in the building. This practice, which is already being enforced in many cities has proven very effective as a fire measure.

METHOD WHICH AIDS IN TESTING FUSES AND CIRCUITS.

By Albert R. Locke.

Considerable trouble has been experienced by plant electricians and others for some time past in testing fuses and grounds in low-voltage branch circuit cabinets. This work requires a suitable test lamp and



Method of Attaching Test Lamp to Circuit Fuse Cabinet.

on account of the bulky and fragile character of these lamps they cannot be conveniently carried around either in one's clothes or in a grip. It often happens therefore that after making a hurried trip to the scene of the trouble, the electrician is obliged to go back for his test lamps or, if he has them with him, finds the lamps broken.

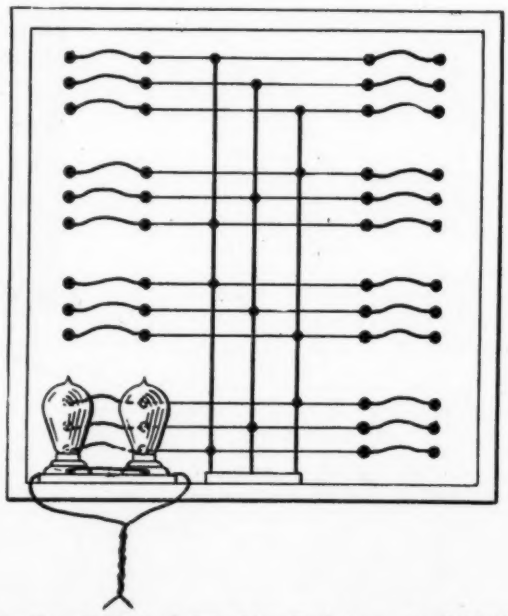
The following method has proven very satisfactory for use on grounded three-phase or two-phase circuits, and on single phase and direct current lines when the neutral or grounded wire is not fused. The method of installation is very simple as can be seen from the sketch. An ordinary socket is mounted on the cabinet and one terminal is connected to a good ground. If the wiring is done in conduit and the cabinet is metal, this ground can be easily secured by connecting the socket to the cabinet. The other terminal is connected to a wire of sufficient length to reach all fuse terminals. The fuses can then be tested or grounded circuits determined by bringing the terminal of this wire into contact with the fuse terminals.

In some cases it may be advisable to install lock-sockets or lamp guards to prevent thefts or breakage. In other cases where the voltage from the fuse terminals to ground exceeds a practical lamp voltage several sockets may be installed in series.

ANOTHER METHOD OF FUSE AND CIRCUIT TESTING.

By W. F. Perry.

Another method of testing fuses and circuits which eliminates carrying unhandy testing apparatus from one cabinet to another is shown in the accompanying sketch. This method employs a lamp socket or



Another Method of Attaching Test Lamp to Cabinet.

where necessary several sockets in series conveniently mounted in or on the fuse cabinet. Wires are connected to both terminals of these sockets and when the ends of these wires are touched to the fuse terminal or circuits the lamp will indicate whether the fuse are blown or the circuit grounded. This method can be used for any kind of service. When desirable the lamps may be protected by a lamp guard or lock-socket.

New Appliances

Improved Electric Gas-Meter Panel—Marine Fittings—Ready to Use Switchboards—Convenient Optical Pyrometer

Improved Instrument Panel for Thomas Electric Gas-Meter.

In order to place the total and graphic records of the gas flow furnished by the Thomas meter in the superintendent's office or near the attendant interested in them, the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has recently developed a new design of instrument panel which requires but very little floor space. The earlier panels carried both the recording and regulating apparatus, but in the new arrangement the instruments are mounted on a separate small panel and the regulator may be located in some other part of the plant convenient for inspection by maintenance men. The meter housing is, of course, located at a point in the pipe line where a measure of the gas flow is desirable.

In accordance with the modern trend of "Safety First" ideas, further refinements have also been made in the design of the instrument panel to make it practically foolproof and shockproof. The new design follows the dead-front principle of switchboard construction, as the accompanying illustration shows. The top section contains the galvanometer, which differs from the usual form of laboratory instrument in that the number of sensitive parts has been reduced to a minimum, in fact, comprising only the moving system and its suspension, and these parts are made easily replaceable, while all other parts are made very strong and durable. The mechanism and connections are placed in an aluminum case and are arranged so that the sensitive parts are well protected but accessible. It is constructed jointly by the Leeds & Northrup Co., and the Cutler-Hammer Manufacturing Co. Most forms of galvanometer are placed in wooden cases and are so constructed that they do not long give good service when used by unskilled mechanics.

The middle section contains the Esterline graphic recording wattmeter, which records in standard units the flow of gas through the meter housing. Below the Esterline instrument is a Westinghouse single-phase indicating wattmeter, with scale calibrated for thousands of cubic feet of gas, which shows the total gas flow. Mounted on the back of the center section is a Square D quick-break ironclad knife switch, operated by a lever on the front of the section, which serves as a main-line switch for the heater circuit and all control circuits. At the left of this switch is mounted a push-button control switch which operates a C-H single-pole remote-control switch. This switch is magnetically opened and closed and mechanically locked and is used to open the heater circuit in the meter housing to permit the operator to balance the meter. The instrument panel also contains a current transformer, for all except the small sizes of meters, and fuses for the recording circuits and test connections for electrically testing the two wattmeters. These wattmeters are standard 5-ampere, 110 or 220-volt instruments, hence they may be tested for accuracy in the same manner as any other standard indicating or integrating electrical instrument, that is, by connecting

Instrument Panel for Indicating and Recording Gas Flow Electrically Through Thomas Meter.

them in series with similar meters of known accuracy. Test constants are stamped on each meter and it is not necessary to shut off the gas or interrupt the gas measurement to test the recording and integrating instruments. All live parts are enclosed in the enclosing case upon which the sections of the panel are mounted and the complete panel is furnished with a cast-iron subbase necessitating no other work in installation than the mere lagging of the base to the floor.

Recent Tests Confirm Claims for Westinghouse Irons.

The Good Housekeeping Institute, a laboratory conducted by the *Good Housekeeping Magazine*, recently made a new test on the 6-lb. electric irons manufactured by seven companies. The results of these tests tend to confirm many of the claims made by the Westinghouse Electric & Manufacturing Co. for its iron.

The Westinghouse iron took 24 sec. longer than the average to heat up to 500°, but it stayed hot 2 min. 28 sec. longer. This indicates the very large storage capacity of this iron. Some of the irons heated a little quicker but these also cooled quicker.

The scorch test made is also very interesting. Eight sheets of thin paper were placed between the sole plate of the iron and the asbestos stand. The current was switched on until the thermometer reached 180° F. as experience shows that this temperature gives the best comparative scorch reading. Although the Westinghouse iron has about the average total area of ironing surface, it has a scorch area of 18% larger than the average iron, 82% of the surface of the Westinghouse iron showing the scorch mark. This further substantiates the claims made by this company that the whole iron irons.

Bryant Plugs and Receptacles for Marine Use.

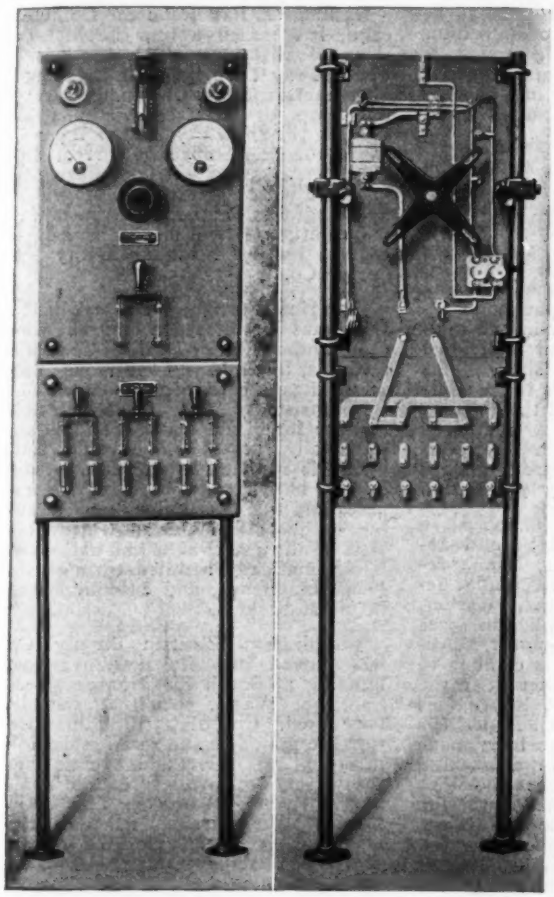
The demand for receptacles and plugs which are adapted for marine use where non-watertight extension cord outlets are desired in officer's quarters, messrooms, cabins and staterooms has caused the Bryant Electric Co. of Bridgeport, Conn., to develop a special Bryant Spartan interchangeable plug type receptacle for this work. These plugs and receptacles offer a distinct advantage, because of the fact that they fit the plugs which are furnished with every fan motor and practically all table lamps and other current-consuming devices.

The base of this plug receptacle is unbreakable composition, as used on all other Bryant marine devices, and the top section is hard white glazed porcelain. This receptacle has a bottom diameter of 1¾ in.; top diameter 1⅜ in.; height 1 13/16 in. A groove of ample size is provided in the base for wires to pass through or to allow wire entrance from the bottom of the box. Brass fastening screws are furnished and kept in place by holding washers. Screw centers are 1⅜ in., which is the standard for all Bryant marine devices.

The type K. D. cap is intended for use on small size flexible cords not over 13/32 in. in diameter. For heavy insulated or metal-armored cables, up to 9/16 in. in diameter, the type M. K. cap is best suited, as it is provided with a strain relief clamp and cord grip. Both of these caps are made of unbreakable composition and will stand severe usage.

Ready to Use Switchboards of Simple Design.

A new line of switchboards particularly adapted for smaller installations has been placed on the market to meet the demand for a simple ready-to-use board. This type of switchboard is suitable for the control of a direct-current generator and three lighting circuits. A marked feature of this type of board is that it can be placed in operation by simply connecting the leads from the generator and feeder circuits to the terminals provided for that purpose. The convenience of this feature contrasts favorably with the usual expense entailed in the purchase of meters, switches, circuit-breakers, slate slabs, framework and the work of designing and assembling the complete panel on the job.



Front and Back View of Type KD Panel.

The installation of the old types of switchboard usually involved a great deal of detail work that is not justified in a small plant. First each piece of detail apparatus must be ordered with careful consideration given to the type and capacity. Drilling templates of each must be secured and a considerable sum must be allowed to cover investment in tools for drilling the slate and bending the copper strap connections.

The accompanying illustrations are typical of the types K. D. and J. D. panels, both of which are suitable for 125 and 250-volt installations up to 600 amperes capacity. These are manufactured by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. Both these types of panels permit a choice in number and capacity of feeder circuits.

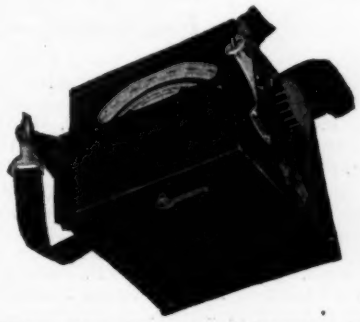
Optical Pyrometer for Convenient Use in Industrial Works.

The Leeds & Northrup Co., Philadelphia, Pa., working under the fundamental Morse patents, has produced an optical pyrometer with a view to realizing a high degree of accuracy and reliability in a simple and portable device. The instrument, which is illustrated herewith, is suitable for measuring from dull red (about 1100° F.) up to the highest known temperature.

The manner in which the luminous radiation from the hot body is balanced against that from a standardized source will be understood from the following description:

A lens is provided by which rays from a hot body are brought to a focus in a plane where there is located a tungsten lamp filament. By means of an eye-piece, the observer views the incandescent filament, which appears to lie upon the image, just as the cross hairs in a surveyor's telescope appear upon the distant object looked at. By means of a rheostat in a case slung about the neck, the case also containing a storage battery and a milliammeter, the current through the lamp is adjusted until the brightness of the filament is just equal to the brightness of the image produced by the lens, that is, so that the filament blends with, or becomes indistinguishable upon, the background focused by the first object. The observer then notes the reading of the milliammeter, which may be provided either with a special scale to read in degrees of temperature, or the temperature corresponding to the current may be read from a calibration curve supplied with the instrument.

The adjustment is made with great accuracy and certainty, as the effect of radiation upon the eye varies some 20 times faster than does the temperature at 1300° F., and some 14 times faster at 3400° F., while as above stated, the eye is very keen in distinguishing differences in brightness between superposed objects.



Milliammeter, Battery and Rheostat for Use with Pyrometer.

The instrument can be calibrated by sighting it upon bodies whose temperatures are known, either by means of a thermocouple pyrometer, or by the melting or freezing of various substances. The constancy or reliability depends upon the constancy of the lamp, that is, its ability always to shine with the same intensity when receiving the same current. This matter has been investigated exhaustively by the United States Bureau of Standards and by the Nela Research Laboratory of the National Lamp Works, also in the laboratory of the Leeds & Northrup Co., and it has been found that after a tungsten filament is thoroughly aged, that is, burned for some time at a temperature higher than that to which it will be subjected in service, no sensible variation thereafter occurs. The instrument is so designed that one lamp can quickly be replaced by another, and by keeping two lamps, their correctness can always be insured by checking one against the other.

The instrument itself is handy and portable, weighing only about a few ounces and can be sighted as easily as an opera glass. The case, containing the battery, rheostat and milliammeter, is designed to be slung about the neck, and weighs about 10 lbs.

The Leeds & Northrup Optical Pyrometer.

Trade Activities

Electric Furnace Closes Large Contract for Heat-Treating Equipment—Literature Distributed by Manufacturers

W. A. Marsden and Stanley E. Howell have taken over the business of **Home Electric Co.**, Seattle, Wash., changing the name to the Electric Appliance Co.

Steel City Electric Co., 1207-1219 Columbus avenue, Pittsburgh, Pa., has appointed R. S. Wakefield to represent the company in the state of Texas. Mr. Wakefield will make his headquarters at 1312 Great Southern Life building, Dallas.

Harvey Hubbell, Inc., Bridgeport, Conn., is sending out a folder on the Hubbell attachment for pull-sockets, which tells its own story in pictures. This handy little device reduces the breakage of lamps and eliminates marring of reflectors. The Hubbell attachment is designed for both brass shell and porcelain pull sockets, the only difference being the increased circumference of the attaching band to fit porcelain sockets.

Hart & Hegeman Manufacturing Co., 342 Capitol avenue, Hartford, Conn., has just prepared Catalog P, listing "H & H" switches and accessories and "Paiste" wiring material. The catalog is one of the handsomest editions of the season and the company is to be congratulated on its general appearance and makeup. This book of 183 pages contains brief and comprehensive descriptions of the "H & H" and "Paiste" line and illustrates each and every item listed. Twenty-two pages of the catalog are devoted to a catalog number index, which is very convenient in making selections of this company's product, and several pages are given over to a pictorial index of "Paiste" pipe taplets.

Davis Slate & Manufacturing Co., Chicago, which claims to be the largest miller of electrical slate and marble, is sending out a very attractive calendar for the year 1919. It is 13 by 32 inches in size and is printed in four colors on a good quality of paper. The calendar follows the very useful plan of showing three months in superposed order, the middle one being the current month. This plan is very convenient in referring to past and future dates. The current month is distinguished from the past and coming months by being printed in black on a light slate colored background, whereas the other months are shown on a darker slate background. The Davis company produces and finishes various kinds of electrical slate, including Penrhyn purple, Penrhyn monsonized, Imperial black and Monson black. The company is also distributing price list No. 6, listing its complete line of products. It contains much valuable information and varies from the usual custom of manufacturers in that prices are quoted per slab.

Meldon H. Merrill and Thomas B. Sweeney announce the organization of the firm of **Merrill, Sweeney & Co.**, engineers, managers and purchasing agents for public service properties, with offices at 50 State street, Boston, Mass.

Multiple Fuse Co., Inc., 450 Fourth avenue, New York City, has issued a very impressive circular entitled, "Keep the Wheels Turning," pointing out the importance of the fuse in industrial plants. Three types of fuses manufactured by the company are described, directing particular attention to the Atlas four-in-one multiple fuse, providing four individual fuses in each cartridge shell. This fuse is approved by both the Underwriters' Laboratories and the Factory Mutual Laboratories. Compared with the standard fuse the Atlas is an original and three spares always at hand to prevent any production loss.

The Hirschy Co., 720 Second avenue South, Minneapolis, Minn., recently issued an illustrated circular describing its latest improved washer. This line of washers is made in three models—Hirschy multi-motor, electric and belt power. It is claimed to be something entirely different in the line of washers, in that it provides a new cone device, which is perhaps the first attempt that has been made to improve the inside of a washing machine. This device prevents clothes from massing in the center of the tub and forces the clothes into a wider circle and a greater volume of water. The slant of the cone gives the water a third motion, causing a much greater water agitation than is usually found in other machines on the market. The top lip on the cone prevents the clothes from rubbing against the dolly, eliminating all wear and tear.

The Edison Lamp Works of the General Electric Co., Harrison, N. J., whose annual calendars are famous for their artistic beauty, coloring, poetic expression, is distributing one for 1919 which in magnificence surpasses all preceding ones. The reproduction is one of a series of paintings especially designed by Maxfield Parrish for the Edison Lamp Works, and it portrays the "Spirit of the Night." The inspiration of the painting is expressed by the following lines, but the coloring must be seen to be appreciated:

"And even the Spirit of the Night
Lured from her far and dusky halls,
Follows the gleam that falls
Across her throne,
And comes to wonder and admire
How man has conquered light and fire
And made their radiance his own."

National X-Ray Reflector Co., Chicago, has issued a new booklet on show-case lighting. This book, entitled "X-ray Display Case Lighting," gives facts and figures about the relative costs of different methods of lighting the show case and explains in detail the importance of correct display case lighting. It is profusely illustrated with interesting photographs and diagrams of wiring and installing these outfits. It will be sent free upon request by the National X-Ray Reflector Co.

Electric Furnace Co., Alliance, Ohio, has just closed a contract with the Standard Roller Bearing Co., Philadelphia, for 190-kw. continuous automatic, heat-treating equipment. The set consists of one 150-kw. electric furnace for hardening and one 40-kw. electrically heated oil drawing bath. There is supplied in addition, an oil-quench bath located between the furnaces and the electrically heated drawing bath. The material, which consists of alloy steel balls and ball races, is automatically handled through the furnaces, quench, and drawing baths, in metal baskets.

Washington Electric Supply Co. has moved into its new five-story building at South 153 Monroe street, Spokane, Wash., which it recently purchased. Consolidated at this location are the office and retail store, formerly at 907 Riverside avenue, and the warehouse formerly on the Spokane International tracks. This building, of slow-burning material construction, is directly located on the Northern Pacific tracks, with facilities for loading and unloading carload shipments direct to the warehouse platform. Commodious and well arranged offices have been established on the ground floor and the remainder of the building is devoted to storing a complete stock of electrical merchandise.

General Electric Co., Schenectady, N. Y., has issued a handsome dealers' catalog of electric fans illustrated in colors. This catalog contains 28 pages and lists a number of new models in addition to the regular line of fans. Each and every part entering into the construction of the fan is described in detail and illustrations showing the details and salient features of the G-E oscillating fan given. A table of weights and dimensions of the various types and sizes of fans and an index to catalog numbers are conveniently placed in the back of the catalog. In addition to the complete listing of this product, it contains much helpful information on the subject of fans, pointing out the industrial importance, hygienic value and the many uses of the G-E electric fan in winter as well as in summer.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rochester, N. Y.—The plant of the New England Telephone Co. was recently damaged by fire to the extent of approximately $4,000.

Brooklyn, N. Y.—Plans have been completed by Julius Kayser & Co., 45 East 17th street, New York, for the erection of the proposed new one-story brick and steel boiler plant, about 50x85 ft., at its works on Classon avenue. The structure is estimated to cost $50,000.

Buffalo, N. Y.—The city has arranged plans for the construction of a new cable and wire plant for municipal service and the installation of a new police signal flash light system in various sections of the city. Bids for the work will be received until Feb. 4. George S. Buck is mayor.

Canisteo, N. Y.—$15,000 has been voted for the purpose of buying the street system of the Larrowe company at a price of $7,000, which went through bankruptcy, to put up a building which will probably be located on the village property back of the department building, and to purchase a 35-hp. oil-burning engine to operate the 50-kw. generator which is included in the invoice of the Larrowe property.

Cohoes, N. Y.—Cohoes Power & Light Corporation is arranging for the issuance of $2,500,000 first mortgage 6% gold bonds, a portion of the proceeds to be used for extensions and betterments. The company operates in Cohoes, Albany, Rensselaer, Waterford and other neighboring municipalities. Frank M. Tait is president.

New York, N. Y.—New York Edison Co., which recently acquired property having a frontage of about 300 ft. on the East river at the foot of 133rd and 145th streets in the Port Morris section, formerly owned by the Schafer Brewing Co., is said to be arranging plans for the construction of a large new power station. The property was held at $350,000.

Brooklyn, N. Y.—Fire on Jan. 11 caused by an explosion in the boiler plant damaged the factory building occupied by the Long Island Feather Co. to the extent of approximately $10,000.

Syracuse, N. Y.—Fire on Jan. 15 which destroyed the boiler plant and a portion of the works of Procino & Rossi, 408 East Division street, caused a damage estimated at $10,000.

Atlantic City, N. J.—In arranging its annual budget for 1919 the city commissioners have requisitioned an appropriation of $77,000 to be used for street and Boardwalk lighting purposes for this period.

Bernardsville, N. J.—Bernardsville Station Garage has arranged with the New Jersey Power & Light Co. for furnishing electric power for the operation of all machinery in the proposed two-story concrete station, about 50x175 ft., ground for which was broken recently.

Chatham, N. J.—The Borough Council has approved an appropriation of $5162 in its annual budget for 1919, to be used for lighting purposes.

Dover, N. J.—The Board of Aldermen has tentatively approved an appropriation of $7770 in its annual budget for 1919, to be used for the operation of the electric street-lighting system.

Dover, N. J.—New Jersey Power & Light Co. has been granted permission by the Board of Public Utility Commissioners to issue 5% first mortgage bonds for $25,000 and 6% general mortgage bonds for $39,000. It is understood that the company will use a portion of the proceeds for extensions and betterments.

Elizabeth, N. J.—New York Telephone Co., 15 Dey street, New York, has completed plans for the erection of a new three-story brick and stone telephone building at 1192-96 East Grand street, estimated to cost $50,000.

Irvington, N. J.—Until Feb. 1 the Board of Education will receive bids for new electrical work in connection with alterations and improvements to be made at public school No. 6, Madison avenue. A. C. Christian is chairman of the building committee.

Irvington, N. J.—Plans are under consideration by the Town Commission for extensions in the electric street-lighting system.

Keyport, N. J.—In arranging the annual budget for 1919 the Council has approved an appropriation of $5-200 for the maintenance of the street-lighting system for this period.

Merchantville, N. J.—The Borough Council is considering plans for the installation of a new fire alarm system throughout the Borough. Volney Bennett is mayor.

Newfane, N. J.—J. A. McCollum is chairman of a committee to plan ways and means to secure improved electric lights.

Newark, N. J.—Utility By-Products Co., 395 Frelinghuysen avenue, has had plans prepared for alterations and improvements in the boiler plant at its works. A permit for the work has been issued.

Paterson, N. J.—Fire on Jan. 13 destroyed the boiler plant at the silk mills of the Ashley Silk Co., Warren street, with loss estimated at $5000.

Rahway, N. J.—The City Commission has approved an appropriation of $10,000 as set forth in the annual budget for 1919, to be used for the maintenance of the electric street-lighting system.

Sandy Hook, N. J.—The United States Government, Bureau of Yards and Docks, has awarded a contract to M. H. Rothschild, Inc., 244 West 79th street, New York, for the construction of a new radio compass station at the local Government site.

Fallsington, Pa. — Pennsylvania Railroad Co. has had plans prepared for the construction of a new two-story brick and steel signal tower at its local property.

Harrisburg, Pa.—Plans are being prepared for the installation of a new electric-lighting plant at the Mont Alto Sanatorium.

Milton, Pa.—Construction work is practically completed on the new power plant being erected at this location by the Construction Division of the Government. The station is estimated to cost $100,000.

Philadelphia, Pa.—The city has awarded final contracts for the erection of the proposed new boiler plant to be located at 24th and Ritner streets, to be constructed in conjunction with a new fire house and police station, the entire work being estimated to cost in excess of $300,000.

Philadelphia, Pa.—In connection with the erection of various structures at the Government Naval Hospital Reservation, it is understood that a pumping plant will be erected. It is proposed to install a new pumping unit with auxiliary equipment. (Specification 3682).

Philadelphia, Pa.—Roxford Knitting Co., Randolph and Jefferson streets, has arranged plans for the installation of new boiler equipment at its plant.

Pittsburgh, Pa.—Carbon Steel Co., 32nd street and Allegheny river, is having plans prepared for the erection of a new one-story boiler plant at its works, about 40x168 ft. in size.

Myersville, Md.—Hagerstown & Frederick Railway Co., Hagerstown, is planning for the reconstruction of its local substation recently destroyed by fire, with a loss of $7500.

Westminster, Md.—B. F. Shriver Co. has awarded a contract for the construction of a new power plant at its works. The J. F. Roystone Engineering Co. is the contractor.

Wilson, N. C.—The flour mill and dynamo used to light the country club burned. L. P. Woodward, owner.

Savannah, Ga.—The Foundation Co., New York, has had plans prepared for the construction of a new

power plant at its local shipbuilding works. Preliminary work on the erection of the proposed structure has been commenced.

NORTH CENTRAL STATES.

Cincinnati, Ohio.—Steps to request city authorities to put into effect at once the contract with the Union Gas & Electric Co. for boulevard lighting in the downtown business section were taken at a meeting of the United Boulevard Lighting Committee at the Business Men's Club. The necessary arrangements were made with the Union Gas & Electric Co. and contracts were signed for boulevard lighting in practically all downtown streets between Central avenue and Broadway and Fourth and Eighth streets at a cost of $100,000. Address Thomas J. Ryan, president of the Business Men's Club.

Hillsboro, Ohio.—The right of way is being secured for an electric road from Hillsboro to Chillicothe. The road is owned by the Hillsboro Cynthiana Bainbridge & Chillicothe Traction Co., Floyd E. Ferman, president, 1844 N. Delaware street, Indianapolis, Ind.

Lima, Ohio.—The city may soon take steps to install a municipal lighting plant for the street lighting system. For the last 10 years current has been furnished by the Ohio Electric Railway Co. under a franchise which will terminate next June. The city has $56,808.95 of a bond issue voted 10 years ago to build a municipal plant available for this purpose. It is estimated that by connecting the plant with the city water works, where two large generators already are in use, that the manufacture of current could be made possible by the expenditure of $100,000.

Lorain, Ohio.—Utilities Construction Co. has petitioned for authority to issue $1,250,000 in bonds for erecting power plant. Address city clerk.

Indianapolis, Ind.—Fire recently destroyed the power plant and drying room at the works of the United States Encaustic Tile Co., 349 West 16th street, with loss estimated at $30,000.

DeKalb, Ill.—DeKalb-Sycamore & Interurban Traction Co. has filed a bill in the DeKalb county circuit court for an injunction to restrain the Illinois Public Utilities Commission from preventng the company to raise its rates, citing that the passenger service is conducted at a loss of $24,000 a year.

Elizabethtown, Ill.—The council is discussing ways and means of securing electric lights for the village. Richard F. Taylor, president of the village board.

Lewiston, Ill.—The council is interested in establishing a municipal lighting system. Address city clerk.

Mattoon, Ill.—Central Illinois Public Service Co. has received a temporary order from the Illinois Public Utilities Commission giving increased rates in 144 towns and cities. The temporary raise was granted pending further investigation by the Commission.

DATES AHEAD.

Pennsylvania State Association of Electrical Contractors and Dealers. Next meeting, Hotel Adelphia, Philadelphia, Jan. 28. Secretary-treasurer, M. G. Sellers, 1518 Samson street, Philadelphia.

Western Association of Electrical Inspectors. Annual meeting, Chicago, Ill., Jan. 28-30. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

Oklahoma Utilities Association. Annual meeting, Oklahoma City, Okla., Feb. 6, 7 and 8. Secretary, H. A. Lane, Oklahoma City, Okla.

Illinois State Association of Electrical Contractors and Dealers. Annual convention, Chicago, Feb. 14 and 15. State secretary, G. A. Engelken, 55 West Harrison street, Chicago.

New Mexico Electrical Association. Annual meeting, Albuquerque, N. Mex., Feb. 17-19. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. Mex.

American Institute of Electrical Engineers. Annual mid-winter convention, Engineering Societies building, New York City, Feb. 19-21. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Wisconsin State Association of Electrical Contractors and Dealers. Annual convention, Hotel Pfister, Milwaukee, Wis., March 24-28. State secretary, John A. Piepkorn, 108 Sycamore street, Milwaukee, Wis.

Wisconsin Electrical Association. Annual meeting, Milwaukee, March 25-27. Secretary, J. P. Pulliam, 1408 First National Bank building, Milwaukee.

Springfield, Ill.—Three applications were filed with the state public utilities commission by corporations for permission to issue stock and bonds. They are: Jacksonville Railway & Light Co. to issue 1230 shares of its preferred stocks, par value, $123,000; the Galesburg Railway, Lighting & Power Co. of Galesburg, to issue bonds in the amount of $350,000; the Illinois Central Traction Co. of Champaign to issue 2450 shares of preferred stocks, par value $245,000.

Kaukauna, Wis.—Plans have been prepared by Engineer W. B. Montgomery, Montgomery, Wis., for remodeling dam and other improvements, generators, waterwheels, gates, sluiceway, for Green Bay & Mississippi Canal Co.

Ladysmith, Wis.—L. C. Meyers Co., engineer, 53 W. Jackson boulevard, Chicago, has prepared plans for construction dam near Ladysmith at a cost of $2,000,000. Big Falls Water Co., owner.

Manitowoc, Wis.—Recommendation has been made to Congress by Secretary of Commerce Redfield for an appropriation of $10,000 for improvements in the fog signal and lighthouse station here.

Oshkosh, Wis.—A permit has been granted for laying conduit from Gas Light Co.'s plant across Broad street to corner of Broad street and Lake Drive. Owner, Eastern Wisconsin Electric Co., B. W. Arnold, manager.

Sheboygan, Wis.—Architect W. C. Weeks, Sheboygan, is preparing plans for telephone exchange for the Citizens' Telephone Co.

Superior, Wis.—Preparations are being made by the city council to purchase lighting plant of the Superior Water, Light & Power Co.

Minneapolis, Minn. — Northern States Power Co. purposes to increase its capital stock from $16,000,000 to $26,000,000. R. F. Pack, general manager.

Atlantic, Iowa.—J. V. White, owner of the Cumberland electric light and power plant, has announced contemplated improvements which will include the building of transmission lines to Bridgewater and Massena.

Dayton, Iowa.—The electric pump at the water tank burned. Address town clerk.

Excelsior Springs, Mo.—Excelsior Springs Light & Power Co. is considering extensions in its system from Excelsior Springs to Kearny, Holt, Lawson and neighboring sections.

Odessa, Mo.—A mass meeting was held recently to discuss the proposition of disposing of the municipal electric light plant here and making a contract with the Green Co. of Pleasant Hill for current for Odessa for 20 years.

Caney, Kans.—The bondholders of the Caney Electric Light Co. have purchased the entire plant at a foreclosure sale held recently for the sum of $23,000. Nothing will be done at present in regard to a new plant, but some time in the spring the town is planning to spend at least $25,000 for a new light plant, lines from which will be run to adjacent towns.

Eldorado, Kans.—City Manager Bert Wells has been conferring with the Kansas Gas & Electric Co., with offices in Wichita, to install 75 more street lights and two additional blocks of white way.

Beatrice, Neb.—Wymore city council has entered into a contract with the Nebraska Gas & Electric Co. to furnish the city of Wymore with current for a period of five years.

Minot, N. Dak.—The City Commissioners have contracted for the installation of 28 three-light ornamental standards on the new steel viaduct over the Great Northern and Soo railroads, current for which will be furnished by the Minot division of Northern States Power Co.

SOUTH CENTRAL STATES.

Louisville, Ky.—The Board of Public Works is considering plans for the establishment of a new municipal lighting plant.

Memphis, Tenn. — Shelby county commissioners contemplate installing electric plant in courthouse for lighting building and operating elevators. Cost, $12,000. Address county auditor.

Decatur, Ala.—Failure of the Alabama Power Co. to supply Albany and Decatur with gas for lighting and cooking purposes has led to a strong protest on the part of the citizens, and to probably quick action in the building here of a municipal power plant, bonds for which were voted some time ago. Address Mayor Nelson.

Clarendon, Ark.—Commonwealth Power Co. is considering the construction of a new electric power plant on its waterfront property. A. Perry is manager.

Fort Smith, Ark.—Fort Smith Light & Traction Co. has closed contract with the Model Window Glass Co. for the complete electrification of its plant, displacing gas equipment. This installation amounts to 75 hp. in motors.

Levy, Ark.—The city is planning for the installation of a new electric-lighting system.

Picher, Okla.—J. McNichols has made a survey for an electric belt line to connect Picher, Couthat and Cardin.

Sulphur, Okla.—The light and power plant of Sulphur was recently destroyed by fire at a loss of $80,000.

Tishomingo, Okla.—The city is considering the erection of a new electric light plant, the structure being estimated to cost $18,000.

Walters, Okla.—Southwestern Bell Telephone Co. is planning to double the capacity of its Walters system, including the installation of a new switchboard, lines and cables.

Cleburne, Tex.—Cleburne Commercial Club is pushing plan to build interurban railway from Cleburne to the West Texas oil fields via Glen Rose. Address W. K. Williamson.

Dallas, Tex.—Dallas Street Railway Co. will spend this year nearly $500,000 for extensions and improvements, this including the proposed North Dallas extensions. Richard Meriwether, manager.

Goliad, Tex.—Probably due to defective wiring, the electric light plant building and contents were destroyed by fire. The loss is fully covered by insurance.

Irving, Tex.—Texas Power & Light Co. is contemplating the installation of a reducer to furnish current for the entire town.

Omaha, Tex.—The electric light plant burned. Address mayor.

San Antonio, Tex.—Fire recently destroyed the power plant at the works of the San Antonio Public Service Co., Villita and South Presa streets, with loss estimated at $25,000.

WESTERN STATES.

Seligman, Ariz.—Steps have been taken for the organization of the Mojave Northern Power Co. for the purpose of building and operating the proposed hydroelectric development on the Colorado river, north of Seligman and Williams. The company will be capitalized at $24,000,000. Surveys have been made for the proposed plant.

Kellogg, Ida.—Bunker Hill & Sullivan M. & C. Co. is remodeling the old Sweeney concentrating mill for retreating the heavy tonnage of tailings that have accumulated in the last 20 years. The mill has a daily capacity of 500 tons. The new equipment is understood to include motors for electric drive.

Chehalis, Wash.—Idaho, Oregon & Washington Light & Power Co. has petitioned the council for an electric light and power franchise. Address O. E. Anderson.

Oakville, Wash.—Rodney Maxwell, civil engineer of Elma, was in the city recently looking over the site for the proposed light and power plant of the city. He states that a longer dam built on Roundtree Creek below the one supplying the city water would cost $1500.

Seattle, Wash.—Plans for the erection of a blacksmith and power house are being prepared by the Skinner & Eddy Corporation. The plant will be 100x220 ft. in size and cost about $4500.

Victoria, B. C.—Engineers are now on the ground running lines and securing data for the drafting of the plans of the hydroelectric plant which the provincial government will install at Squamish to provide power and light for the P. G. S. terminal plant there as well as for the town of Squamish. The enterprise will call for an outlay estimated at between $40,000 and $50,000.

Reedsport, Ore.—An electric light plant, to be known as the Reedsport Electric Light Co., was organized here with a capital of $4000. The power will be generated at the Johnson mill, and work of installation is to be executed immediately.

Alturas, Cal.—Plans are now under way for the installation of pumping stations along the Pitt river for the purpose of furnishing water for irrigation purposes. It is understood that arrangements have been made with the Alturas Electric Light & Power Co. for the erection of five miles of transmission line and the installation of at least 65 hp. in motors.

El Moro, Cal.—Colony Holding Co. is building a new power plant in this section to be known as the Atascadero power plant. Considerable work in the new station will be handled by Renard & Stary, electrical contractors of Los Angeles.

San Francisco, Cal.—The Motor Transportation Corps, which has charge of the wheeled vehicles in the army, has under consideration the construction of a repair shop in San Francisco similar to those in the East and South, to cost from $750,000 to $1,000,000.

INCORPORATIONS

Harrison, N. J.—Liberty Lamp Works, Inc. Capital, $25,000. To manufacture electric lamps and other electrical specialties. Incorporators: Daniel J. Delaney, M. H. Rosenberg and F. M. Delaney.

New York, N. Y.—Marine Electric Co. Capital, $30,000. To engage in electrical marine contracting. Incorporators: W. H. Scoti, O. E. Miller and R. Elkan, 15 Whitehall street.

New York, N. Y.—Maxim Electrical Corporation. Capital, $25,000. To manufacture electrical specialties. Incorporators: S. M. Knopf, F. E. Buttner and J. Harris, 1547 Broadway.

New York, N. Y.—Donnell-Zane Co,. Inc. Capital, $25,000. To engage in general electrical and mechanical engineering. Incorporators: J. C. O'Donnell, 148 West 97th street, New York; H. J. Zane, Jr., Orange, N. J., and C. Ridenour, Millwood, W. Va.

Buffalo, N. Y.—Willis Electric Corporation. Capital, $100,000. To manufacture electrical specialties, etc. Incorporators: James A. Willis, E. B. Parson and S. C. Oyer, all of Buffalo.

Wilmerding, Pa. — Westinghouse Air Brake Home Building Co. Nominal capital, $5,000. To handle a housing development for the employes of the Westinghouse Air Brake Co. Alexander Black, Pittsburgh, is the principal incorporator.

Little Rock, Ark.—W. P. Galloway Co. Capital, $50,000. To operate a local electric plant. Incorporators: W. P. and M. R. Galloway and D. B. Howland.

Nova, Ohio.—Nova Electric Lighting Co. has incorporated with a capital of $5,000 by W. M. Thiedman.

Wakefield, Neb.—Wakefield Electric Co. has incorporated with a capital of $25,000 by R. H. Mathewson.

Littlefork, Minn.—The Littlefork Light & Power Co., Ind., has incorporated with a capital of $10,000, by Ernest E. Polkinghorne, and will furnish light and power.

Lowndesville, S. C.—The Lowndesville Light & Power Co. has incorporated with a capital of $5,000 by M. P. McCalla, R. T. Broadwell and others, all of Lowndesville.

Camden, N. J.—Cape May Court House Light & Power Co. Capital, $50,000. To operate a local plant. Incorporators: M. E. Boyd, Philadelphia, Pa.; Frank Maris, Lansdowne, Pa., and James H. Birch, Jr., Burlington.

Philadelphia, Pa.—National Electric Welding Co. Capital, $50,000. To operate a general electrical welding and repair establishment. Incorporators: F. H. Hansell, E. M. MacFarland, Philadelphia, and J. V. Pimm, Camden, N. J.

Ranger, Tex.—Ranger Light & Power Co. Capital, $20,000. To operate a local electric light and power plant. S. C. Green is the principal incorporator.

PROPOSALS

Turbines, Pump Set, Etc.—Bids will be received at the office of the Mississippi River Commission, first and second districts, customhouse, Memphis, Tenn., until Feb. 4 for furnishing turbines, pump set, feed-water heater and electric light plant.

Boilers.—Bids will be received by the Mississippi River Commission, first and second districts, customhouse, Memphis, Tenn., until Feb. 4, for furnishing boilers for hydraulic grader No. 1820.

Electric Crane.—Bids will be received by the Port of Seattle Commission up to Feb. 9 at 2 p. m. for a Gantry electrically-operated crane for Pier "B" at Smith's Cove terminal, to cost about $90,000.

Personal

G. E. Pingree Joins Staff of International Western Electric—Charles R. Underhill Returns to Acme Wire Co.

CAPTAIN M. M. MURPHY, of the United States Engineers, has returned to the Seattle office of the Westinghouse Electric & Manufacturing Co. He will take up the work of application of the company's product to mining and smelting operations.

GEORGE E. CULLINAN, who recently resigned as manager of the St. Louis district of the Western Electric Co., Inc., to become central district manager of the company, was tendered a testimonial dinner on the occasion of his departure from St. Louis, Mo. About 166 friends and business associates were in attendance, many of whom are prominent men in the electrical industry.

CHARLES R. UNDERHILL, until recently captain in the Air Service Aeronautics, received his discharge from the army on Jan. 8 and has returned to New Haven, Conn., in the capacity of chief electrical engineer for the Acme Wire Co. For some time Captain Underhill was in charge of tests in flight for the Radio Development Section of the Signal Corps at Langley Field, and when this work started at Little Silver he was transferred to the School for Aerial Observers at Langley Field, where he organized the Radio Department and the Simulative Artillery System. Later Captain Underhill was transferred to the Division of Military Aeronautics, Washington, D. C., where he specified the radio equipment for Air Service Operations.

G. E. PINGREE has been appointed vice-president and general manager of the International Western Electric Co., Inc., and vice-president and managing director of the Western Electric Co., Ltd., Canada., succeeding Gerard Swope, who resigned to become president of the International General Electric Corporation. Mr. Pingree joined the Western Electric Co. in 1903, after graduation from Dartmouth College, and his early work was in the clerical and financial department of the Clinton street office in Chicago, then the executive headquarters of the company. He occupied successively positions in the Cincinnati and Chicago offices, and was assistant treasurer at New York and at one time general telephone sales manager, with headquarters at New York. In 1908 Mr. Pingree went to China as the company's special representative in the Far East and upon his return was appointed to the position of managing director of the company's London house. This position Mr. Pingree has since occupied, in charge of the company's extensive engineering, manufacturing and sales activities at that point. During the past six months he has been in New York, which will be his headquarters after May 1. Mr. Pingree is spending the intervening time on a short trip to England, France, Belgium and Italy.

NORMAN G. REINICKER, formerly connected with the New York Edison Co., is now with the Du Pont interests in charge of the power plant at Nashville, Tenn.

JOSEPH L. OSMAN, Bordentown, N. J., chief telegraph operator of the Pennsylvania Railroad Co., and connected with the company over 55 years, has retired. Mr. Osman is 67 years of age.

JAMES F. HAMILTON, Rochester, N. Y., president of the New York State Railways, has been elected president of the Schenectady Railway Co., to succeed Horace E. Andrews, deceased.

VRATISLAV A. ZEHR, consulting engineer of the E. T. Perkins Engineering Co., Chicago, formerly in charge of the Green Bay Levee & Drainage District construction, is now superintendent of construction at the Rocky Ford Drainage District, Pekin, Ill.

HERBERT B. REYNOLDS, formerly a fuel engineer in the United States Bureau of Mines, has returned to the motive power department of the Interborough Rapid Transit Co., New York City, in the capacity of mechanical research engineer.

C. E. COLLIER, who has been with M. B. Austin & Co., Chicago, for a number of years, has accepted a position as traveling salesman for the Arrow Electric Co., making the Chicago office his headquarters. Mr. Collins is well known in the electrical business and will no doubt be instrumental in making Arrow products even more popular than they are.

JOSEPH L. MUELLER, who has for the past 10 years been associated with the Tingley Electric Co., Green Bay, Wis., has severed his connection with that concern to engage in business for himself. Mr. Mueller has been prominent in local electrical circles for the past 13 years, having had charge of the largest installations of electrical equipment made during that time.

JOHN R. SMITH, formerly with the Freeman Sweet Co., has recently joined the Chicago office of the William A. Carrao Elecirtc Co., electrical contractor. Mr. Smith is a graduate of the University of Wisconsin and has had a very wide experience. As a consulting engineer he designed the electric, plumbing, heating and ventilating installations of many notable buildings in Chicago, New York and on the Pacific coast. One of the most prominent of these is the Meier & Frank department store in Portland, Ore. He is secretary of the Chicago Electrical Estimators' Association and has played a very active part in developing the many recent improvements for electrical contractors which have been brought about by this association, such as the "unit price" system and the chart for determining overhead percentage.

S. W. BARKER, formerly with the National Carbon Co. at San Francisco, has succeeded the late J. W. Leighton as representative of the company, with offices at 421 L. C. Smith building, Seattle.

WALTER S. LOCKWOOD, formerly advertising manager of the Toledo Scale Co., Toledo, Ohio, has become advertising manager of the Johns-Manville Co., New York.

CAPT. GEORGE B. NICHOLS has obtained his discharge from the Engineering Corps of the U. S. army and has returned to his former position of chief engineer in the Department of Architecture, Albany, N. Y.

J. F. OWENS, vice-president and general manager of the Oklahoma Gas & Electric Co., has been appointed chairman of the Speakers' Committee for the Conference of the Rotary Clubs of the 17th District, comprising Missouri, Kansas and Oklahoma, to be held in Oklahoma City, Feb. 13 and 14.

GEN. GUY E. TRIPP, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., will sail for England on Jan. 29. He will be accompanied by several officials of the company, and it is expected that the party will be away about six weeks. The object of this trip is to further plans for enlarging the export business of the company.

LEAVITT EDGAR, who prior to his enlistment in Government service was superintendent of the field statistics department of the statistical bureau, Edison Electric Illuminating Co., Boston, has been appointed assistant general superintendent of the operating bureau, and will assume his new responsibilities immediately upon his discharge from military service. After completing his education, Mr. Edgar was associated with the General Electric Co. for a few months, his particular work being in connection with the construction of the Vernon Dam at Brattleboro, Vt. He became connected with the Edison Electric Illuminating Co. on Aug. 1, 1911, serving for short periods in several departments of the company—the laboratory, sales department, electrical engineering, installations department, special service and latterly the general superintendent's office until his appointment as superintendent of the field statistics department of the statistical bureau on Feb. 9, 1916. Mr. Edgar was active in securing data in connection with the possible mobilization of industries in the event that the United States entered the war, this work being done directly for the Massachusetts Board of Directors of the Naval Consulting Board. On Oct. 14 last he was commissioned a first lieutenant in the Quartermaster's Corps, Construction Department.

For the Reconstruction Period—What?

XXI.

THIS STATEMENT issued by the Guaranty Trust Co. of New York City, brings out very clearly a fact too often ignored of late, viz., that it is the great American market on which we must chiefly depend in adjusting our industries to a new peace basis. Opportunities for foreign trade must not be neglected, but let's keep our perspective true.

C. A. TUPPER CHICAGO
President INTERNATIONAL TRADE PRESS, Inc.

Exaggerating Reconstruction Needs of Europe

Except in the matter of supplying certain raw materials and some machinery, the industrial capacity of France will largely care for her immediate reconstruction demands. Many students are inclined to believe that the destroyed industrial plants will not be rebuilt to pre-war capacity, at least not until some period of time has elapsed and the trade of France has expanded so that there will be need for additional industrial capacity.

Belgium from an industrial standpoint is not in as favorable a position as France because the major portion of the country was under the control of the Germans. She has need for replenishing the material equipment of her factories and to rebuild them before she can be in a position to produce those materials that will be needed for further reconstruction. Fortunately, her rich African possession in the Congo region gives her an important source of raw materials. It is remarkable that development work should have been continued during the war to such an extent that last year the Belgian Congo produced 40,000 tons of copper. The Germans will be required undoubtedly to rebuild as much of Belgium as practicable. England and the United States, however, will share in the rebuilding of the heroic little kingdom.

But it is well for American industrial leaders to recognize that we ought not to make the mistake of overestimating the probable demand for American products that will grow out of reconstruction in France and Belgium. During the Napoleonic wars great improvements were made in the technique of production in English industries and their leaders overestimated, with serious consequences, the buying demand of the Continent of Europe. And no more serious mistake could be made today, than to indulge in a feeling of security and confidence for the immediate future of American industry based chiefly upon the reconstruction demands of Europe.

Financial News

Large Gains Shown by Automatic Electric Co.

Large gains in both gross and net earnings are shown in the financial statement of the Automatic Electric Co., which was given out recently. The statement and comparisons follow:

	1918.	1917.
Gross profit	$849,990	$666,918
General expenses	110,463	.....
Taxes and interest	72,313	.....
Selling expenses	191,910	.....
Advertising	52,426	.....
Total expenses	$427,112	$412,117
Net profit	422,878	254,801

The balance sheet as of Dec. 31, 1918:

ASSETS.

Patents, good will, etc	$4,006,313
Machinery, tools and fixtures	688,970
Securities owned	667,586
Inventory	1,391,998
Notes receivable	14,809
Accounts receivable	474,216
Cash	175,320
Sundry assets	102,501
Deferred assets	72,920
Total assets	$7,594,642

LIABILITIES.

Capital stock	$5,074,520
Accounts payable	198,239
Notes payable	362,708
Partial payments on contracts	106,019
Deferred liabilities	62,066
Reserves	296,071
Surplus account	1,495,019
Total liabilities	$7,594,642
Unfilled orders on hand Dec. 31, 1918	$1,090,592

A. T. & T. Bond Allotments.

Allotments of the American Telephone & Telegraph Co.'s double offering of bonds and notes, which were largely oversubscribed, were made as follows: Subscriptions for $5,000 New York Telephone bonds, allotted in full; $6000 to $10,000 subscriptions, 90% allotted with minimum of $5000; $11,000 to $50,000, 50%, with minimum of $9000; $51,000 to $250,000, 40%, with minimum of $35,000; over, $250,000, 25%, with minimum of $100,000. A. T. & T. note allotments were substantially the same.

Westinghouse Electric Earnings.

In a statement issued by Guy S. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Co., in reference to its new issue of notes to take up $15,000,000 6s maturing Feb. 1 next, he says the amount earned in eight months to Nov. 30 last, with which to meet all taxes and charges, was $19,018,030. The company earned in the eight months at the rate of $9.74 a share per annum on $74,812,650 capital stock, both common and preferred, against $10.29 a share earned in the entire fiscal year ended March 31, 1918. The new notes mature Feb. 1, 1920.

Allis-Chalmers Earnings Drop.

A New York dispatch says it is learned reports for the three months ended Nov. 30 last show that Allis-Chalmers Manufacturing Co., after allowing $7 a share on the preferred, shows earnings at the rate of $8 per annum on the common stock. This is quite a decrease from what has been recently reported as the present rate of income for the company.

Poughkeepsie Company to Issue Share of Unissued Capital Stock.

Central Hudson Gas & Electric Co. has filed application with the Public Service Commission for permission to issue shares of its unissued capital stock, as now or hereafter authorized, in exchange for 10-year convertible debenture bonds of the company, the proceeds it is understood, to be used for expansion and extensions. The application supplements one filed on Dec. 13, requesting permission to issue $750,000 in 10-year convertible bonds, to be used for this purpose. The authorized capital stock of the company is $2,500,000, of which $1,754,800 has been issued.

Dividends.

Cities Service Co. has declared the regular monthly dividend of one-half of 1% on the common stock; also the usual 1% stock dividend on the common, all payable March 1 to stock of record Feb. 15.

Marconi Wireless Telegraph Co. has declared a dividend of 5%, payable July 1 to stock of record June 1.

A quarterly dividend of 1% has been declared by the Columbia Gas & Electric Co., payable Feb. 15 to stock of record Jan. 31.

A quarterly dividend of 1½% has been declared on the preferred stock of the Public Service Investment Co., payable Feb. 1 to stock of record Jan. 16.

Earnings.

PENNSYLVANIA UTILITIES CO.

Item.	November 1918.	November 1917.
Gross revenue	$152,027.62	$131,194.17
Operation, taxes and expenses	104,664.80	108,498.01
Income before charges	$ 47,362.82	$ 22,696.16

	11 months ending Nov. 30, 1918.	11 months ending Nov. 30, 1917.
Gross revenue	$1,452,827.19	$1,089,741.70
Operating expenses and taxes	1,089,771.14	910,086.60
Income before charges	$ 363,056.05	$ 179,655.10

DAYTON POWER & LIGHT CO.

	November, 1918.	November, 1917.	11 months ended Nov. 30, 1918.	11 months ended Nov. 30, 1917.	12 months ended Nov. 30, 1918.	12 months ended Nov. 30, 1917.
Gross earnings	$260,472	$187,665	$2,162,929	$1,673,944	$2,369,603	$1,844,000
Operating expenses (including depreciat'n and taxes)	169,402	121,590	1,500,514	1,124,877	1,642,182	1,254,247
Net earnings	$91,070	$66,075	$662,415	$549,067	$727,421	$589,753
Non-operating revenue	3,554	533	29,790	9,278	30,846	10,101
Total income	$94,624	$66,608	$692,205	$558,345	$758,267	$599,854
Interest on bonds	$32,192	$15,121	$321,318	$166,499	$336,439	$181,704
Other deductions (includes other interest and sinking fund)	12,991	12,161	131,539	113,487	142,410	126,711
Total deductions	$45,183	$27,282	$452,857	$279,986	$478,849	$308,415
Net income	$49,441	$39,326	$239,348	$278,359	$279,418	$291,439
Dividends on prefer'd stock	34,271	14,813	164,171	162,938	178,984	177,750
Surplus	$34,170	$24,513	$75,177	$115,421	$100,434	$113,689
Operating ratio	65.04%	64.79%	69.37%	67.20%	69.30%	68.02%

BID PRICES OF SECURITIES OF LEAD-WEEKLY COMPARISONS OF CLOSING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Jan. 14.	Bid Jan. 21.
Adirondack Electric Power of Glens Falls, common	6	12	11
Adirondack Electric Power of Glens Falls, preferred	6	71	68
American Gas & Electric of New York, common	10+extra	98	100
American Gas & Electric of New York, preferred	6	43	43
American Light & Traction of New York, common	..	244	235
American Light & Traction of New York, preferred	6	99	98
American Power & Light of New York, common	4	53	56
American Power & Light of New York, preferred	6	74	75
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	7	35	35
American Telephone & Telegraph of New York	..	100	100
American Water Works & Elec. of New York, common	..	5¼	4
American Water Works & Elec. of New York, particip	7	11	10
American Water Works & Elec. of New York, first preferred	..	66	65
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	15	12
Cities Service of New York, common	+extra	293	285
Cities Service of New York, preferred	6	80	76½
Commonwealth Edison of Chicago	8	117	114½
Comm. Power, Railway & Light of Jackson, common	..	19	20
Comm. Power, Railway & Light of Jackson, preferred	6	41	40
Federal Light & Traction of New York, common	..	8	8
Federal Light & Traction of New York, preferred	..	40	39
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	20	20
Middle West Utilities of Chicago, preferred	6	50	50
Northern States Power of Chicago, common	..	59	57
Northern States Power of Chicago, preferred	ex.div.7	90	87
Pacific Gas & Electric of San Francisco, common	..	46	47
Pacific Gas & Electric of San Francisco, preferred	6	85	85
Public Service of Northern Illinois, Chicago, common	7	90	90
Public Service of Northern Illinois, Chicago, preferred	6	91	90
Republic Railway & Light of Youngstown, common	4	17	16
Republic Railway & Light of Youngstown, preferred	6	51	50
Standard Gas & Electric of Chicago, common	..	12½	13
Standard Gas & Electric of Chicago, preferred	6	31	31
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	12½	13
United Light & Railways of Grand Rapids, common	4	37	37
United Light & Railways of Grand Rapids, preferred	6	70	70
Western Power of San Francisco, common	..	17	17½
Western Union Telegraph of New York	extra	87	87
Industrials—			
Electric Storage of Philadelphia, common	4	53¼	53
General Electric of Schenectady	8	149	147
Westinghouse Electric & Mfg. of Pittsburgh, common	7	41	41
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	55